APPENDIX D

DESCRIPTION AND TECHNICAL ASSESSMENT OF THE COATING CATEGORIES

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In this chapter, we provide a discussion of each of the 44 architectural coatings categories included in the proposed SCM, as well as 16 categories that are included in the United States Environmental Protection Agency's (U.S. EPA's) national architectural coatings rule, but not in the Suggest Control Measure (SCM). This chapter is divided into three sections. Section A, "Coating Categories for Which We Are Proposing New VOC Limits," discusses the 28 coating categories in the SCM where we are proposing VOC limits that are generally lower than those in existing district rules (excluding the SCAQMD). These discussions provide more background and technical analysis than those in Section B and C. Section B, "Coating Categories for Which the Proposed VOC Limits are Generally Consistent with District Rules," discusses the 16 coating categories in the SCM where we are proposing VOC limits that are generally consistent with the VOC limits in existing district rules. The discussions in this section explain why we believe the existing VOC limits in district rules are appropriate for the proposed SCM. Finally, Section C, "Categories Not Proposed for Inclusion in the Suggested Control," discusses the coating categories that are not included in the proposed SCM, but are included in the U.S. EPA's national architectural coatings rule. These discussions explain why we believe it is unnecessary to include a separate category for these products in the proposed SCM.

In general, the VOC limits in the proposed SCM are modeled after the interim limits in the South Coast Air Quality Management Disrict (SCAQMD's) Rule 1113, except that they have an effective date of January 1, 2003 (except for industrial maintenance coatings which have an effective date of January 1, 2004). The effective dates are later than those in Rule 1113, because we wanted to provide roughly the same three-year reformulation time provided by the SCAQMD. Also consistent with Rule 1113 and most other district architectural coatings rules, coating products sold in containers of one liter or less are exempt from the proposed VOC limits in the SCM.

The discussions of the proposed VOC limits for each of the coating categories explain why we believe that they are technologically and commercially feasible by the proposed effective date. Our analysis of each coating category relies on information from many sources, including trade journals, the ARB's 1998 Architectural Coatings Survey, discussions with manufacturers and resin suppliers, and the results of laboratory tests of both complying and noncomplying products. However, we will also monitor industry's progress toward achieving the proposed VOC limits in the SCM, to ensure that manufacturers are able to satisfy the overall market demand for these products.

A. COATING CATEGORIES FOR WHICH WE ARE PROPOSING NEW VOC LIMITS

We are proposing VOC limits for the following 28 coating categories that are generally consistent with the interim VOC limits adopted in recent amendments to the SCAQMD's Rule 1113 (with the exception of antenna coatings, antifouling coatings, clear brushing lacquers,

flow coatings, high temperature coatings, pretreatment wash primers, swimming pool repair coatings, and waterproofing sealers). However, in many cases, the proposed limits are lower than the existing VOC limits in other district rules in California. Therefore, the discussions of these coating categories are more detailed than those for the other categories. The discussions for each of these coating categories include: 1) product category description; 2) information on product use and marketing; 3) information on the existing product formulations; 4) discussion of the proposed VOC limit, our rationale for the proposed limit, and the options for compliance; and 5) if applicable, a discussion of the issues associated with the proposed VOC limit, as raised by the affected industry. After the Flat and Non-Flat categories, the product categories are in alphabetical order.

1. Flat Coatings

Product Category Description:

Flat coatings are widely used on both interior and exterior surfaces of residential and commercial buildings. Flat coatings leave a matte finish, with no gloss or shine. They are defined as having a gloss of less than 15 on an 85^{o} meter or less than 5 on a 60^{o} meter. The flat finish tends to minimize surface irregularities and imperfections.

Table D-1 below summarizes our estimate of sales and VOC emissions from the flat coatings category based on ARB survey results. The ARB survey (ARB, 1999) shows that flat coatings represent the largest coating category with regard to both sales volume and VOC emission levels. In 1996 (the year surveyed), approximately 32 million gallons of flat coatings were used in California. This represents about 36 percent of the total California sales volume of architectural coatings in 1996. The VOC emissions from flat coatings in California, excluding those emissions that occur in the SCAQMD, are about 8.0 tons per day. VOC emissions from flat coatings represent approximately 15 percent of the total emissions from architectural coatings. Because most of the products sold are water-based, most of the emissions are from water-based products, even though these products have a lower sales-weighted average VOC content than solvent-based products.

Table D-1
Flat Coatings*

	Number of Products	Category Sales (gallons/year)	Sales-Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	56	27,873	373	0.06
Water-Based	2,299	31,800,868	98	7.94
Total	2,355	31,828,705	98	8.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
** Grams VOC per liter of coating, less water and exempt compounds.

Product Use and Marketing:

Typically, flat coatings can be brushed, rolled, or sprayed on the surface to be painted. Flat coatings make up approximately 80 to 90 percent of the total coatings used for residential applications (SCAQMD, 1996). "Do-it-yourselfers" and paint contractors can purchase flat coatings at outlets including hardware stores, home supply stores, and retail paint stores. Flat coatings are used on interior walls and ceilings, and are typically used to paint living rooms, dining rooms, bedrooms, and halls. Flat coatings are also used on exterior walls and overhangs. With proper surface cleaning and priming (if necessary), flat coatings can be used on a large variety of interior and exterior substrates including drywall, plaster, wallpaper, brick, concrete block, wood siding, vinyl siding, aluminum siding, and stucco. Because most flat coatings are water-based, soap-and-water cleanup is typical. Most flat coatings (about 97 percent) are sold in size units greater than one liter (ARB, 1999).

The 1998 ARB survey showed that about 41 percent of the flat coatings sold in 1996 were formulated for interior applications, 30 percent for exterior applications, and 29 percent were formulated for both interior and exterior applications (ARB, 1999).

For marketing their products, some manufacturers of "zero VOC" flat coatings emphasize the health benefits of using such coatings versus conventional coatings. The benefits include the low-to-minimal odor of zero VOC coatings and the reduced chemical exposures from the use of such coatings. Because of those features, manufacturers of zero VOC coatings emphasize the coatings' suitability for use in enclosed centrally-ventilated buildings (e.g. schools, office buildings, and hospitals), rooms that need to be occupied soon after painting (e.g. restaurants, hotel rooms), and residences.

Product Formulation:

As discussed earlier, most flat coatings are water-based. The 1998 ARB survey (which represents 1996 sales as reported) shows that water-based flat coatings represent over 99 percent of the flat coatings market. Solvent-based flat coatings represent 0.1 percent of the market and generally have VOC levels greater than 250 g/l, the VOC limit for flat coatings currently in effect for those California air pollution control districts that have architectural coatings rules. The volume of solvent-based flat coatings sold has decreased approximately 54 percent since the 1993 ARB survey of architectural coatings (which reflected 1990 sales), while overall sales of flat coatings has remained about the same. The overall sales-weighted average VOC level for flat coatings has decreased 7 percent since the 1993 ARB survey (ARB, 1999).

Generally, the type of binder used in a formulation has a large influence on the amount of VOC needed. Binders serve to hold the paint together in a film and to provide adhesion to the substrate. The solvent-based coatings in this category are commonly formulated using alkyd resins as binders. The binder in water-based flat coating is typically a dispersion of synthetic resin particles, called latex. Thus, these types of coatings are commonly called latex coatings. A wide variety of synthetic polymers are used as binders in latex coatings. Two common latex binders are acrylic and vinyl-acrylic resins.

The VOCs in water-based coatings perform one or more of the following functions: binder coalescing aid, polymer plasticizer, freeze/thaw stabilizer, defoamer, and carriers for other additives such as colorants, thickening agents, surfactants, and biocides. The largest contributors

of VOCs in latex coatings are glycols, added mainly to provide freeze/thaw resistance, and coalescing solvents such as 2,2,4-trimethyl-1,3-pentanediol isobutyrate (Texanol®), to allow the latex particles to come together to form a film (Klein, 1993). Generally, so called "zero VOC" coatings contain very small amounts of VOCs. Lower-VOC coatings tend to be formulated using binders that require less coalescing solvent and/or are formulated using less VOCs for freeze/thaw stabilization (Klein, 1993; Currie, 1993).

Proposed VOC Limit and Basis for Recommendation:

We recommend a 100 g/l VOC limit for flat coatings, effective January 1, 2003. The proposed VOC limit is technologically and commercially feasible by January 1, 2003, based on our review of ARB survey data on market shares and product information from manufacturers, as discussed below. The proposed VOC limit is lower than the national limit recently promulgated by the United States Environmental Protection Agency (U.S. EPA) for this category. The U.S. EPA divides flat coatings into interior and exterior categories, but the same VOC limit, 250 g/l, applies to both (U.S. EPA, 1998). In California, the 1989 SCM for architectural coatings recommended a 250 g/l VOC limit for flat coatings (ARB, 1989); this is the most common limit currently in effect for those California air pollution control districts that have architectural coatings rules. In 1996, the SCAQMD adopted a 100 g/l limit for flat coatings that will become effective July 1, 2001, and also adopted a 50 g/l limit that will become effective July 1, 2008. Our recommended limit is consistent with the interim limit adopted by the SCAQMD.

As shown in Table D-2, the 1998 ARB survey found that about half of the market share of flat coatings complies with the proposed VOC limit. Nearly 1,100 products of the approximately 2,400 products reported already comply with the proposed limit. Of the 45 companies that reported in this category, 36 offered flat coatings that comply with the proposed limit. Products with a VOC content equal to or lower than 50 g/l represent about 18 percent of the market, and products with a VOC content equal to or lower than 150 g/l represent 88 percent of the market. (ARB, 1999).

The table below also shows that VOC emission reductions in the non-SCAQMD portion of California would be approximately 1.4 tons per day, on an annual average basis, from implementing the proposed limit of 100 g/l.

Table D-2
Flat Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
100	1,097	48.5	1.39

***** Based on ARB's 1998 Architectural and Industrial Maintenance Coatings Survey (ARB, 1999).

Considering flat coatings formulated for interior and exterior use separately, the 1998 ARB survey indicates that 69 percent (550 products) of the volume of interior flat coatings sold comply with the proposed limit, 42 percent (276 products) of the volume of exterior flat coatings sold comply, and 27 percent (143 products) of the volume of coatings sold for both interior and exterior use comply (ARB, 1999).

The high market shares that already comply with the proposed limit demonstrate widespread use of existing low-VOC technology for formulating flat coatings. While almost all flat coatings are currently water-based latex coatings, the proposed limit would require more water-based products to be formulated using lower-VOC technology. As discussed above, the primary sources of VOCs in latex coatings are coalescing solvents and VOCs (glycols) added mainly to provide freeze/thaw resistance. We expect that product reformulation to meet the proposed limit would involve switching to a binder (or blend of binders) that requires less coalescing solvent and/or reducing the amount of glycol that is added to provide freeze/thaw stability (Klein, 1993, Currie, 1993).

Of note is that most solvent-based flat coatings used in districts without architectural coatings rules do not meet the 250 g/l limit currently in place in district architectural coatings rules. Such solvent-based coatings will at a minimum have to be reformulated (likely to water-based) to meet the national rule limit of 250 g/l in those California districts that do not adopt architectural coatings rules.

Product information from manufacturers

Product information sheets published by coatings manufacturers indicate that a wide variety of flat coatings that meet the proposed VOC limit are available that possess performance characteristics similar to higher-VOC coatings. At the end of the discussion of this category are tables of information about specific products that meet the proposed VOC limit and, for comparison, products that exceed the proposed limit. We identified specific products with a VOC content of 100 g/l or less offered by brands that include Behr, Devoe, Dunn Edwards, Frazee, ICI-Dulux, Rodda Paint, Sherwin Williams, and Tru-Test. A list of performance characteristics compiled from product information sheets for interior and exterior flat coatings with VOC levels of 100 g/l or less is presented below. Please note that not all flat coatings with VOC levels at or below 100 g/l possess all of the characteristics listed below:

Interior flat coatings
good quality, high quality, premium quality, top of the line quality
good to excellent hiding qualities, good dry hiding
durable crack-resistant long-lasting finish
excellent adhesion
excellent color and sheen uniformity
non-yellowing
good to excellent touch-up properties
good stain resistance
washable to extremely washable, durable, long-lasting protection
easy application
excellent freeze-thaw resistance
high film build without sags or runs

Exterior flat coatings
quality product, top of the line, premium quality
long-lasting durability, durable and tough

exceptional coverage
excellent adhesion
low temperature application to 35^{o} F
maximum protection against UV color fade, efflorescence, water intrusion, and film failure, fade and chalk resistant
resists blistering, peeling, and flaking
easy application
very good to excellent touch-up
good hide
exceptional mildew resistance

Issues:

1. Issue: The flat coatings category covers a broad range of products. The ARB should consider subcategorizing the flat coatings category to allow for a higher VOC limit for special use, high performance products. A specific suggestion is to split the flat coatings category into interior and exterior subcategories with different VOC limits for each.

Response: The information we reviewed does not substantiate the need to subcategorize the flat coatings category. Our survey of product information published by coating manufacturers indicates that a wide variety of product types in the flat coatings category already comply with the proposed limit. This includes coatings formulated specifically for acoustic ceilings, coatings formulated for contractors (which emphasize features such as ease and speed of application, hiding properties, and touch-up properties), texture coatings, high-build coatings, coatings designed for low temperature application, and premium quality coatings.

As discussed above, information on market shares obtained from the 1999 ARB survey indicates that a considerable portion of interior and exterior flat coatings already comply with the proposed limit. Our survey of product information for flat coatings that comply with the proposed limit (summarized above) shows that a variety of performance characteristics comparable to those of higher VOC products have been achieved for both interior and exterior flat coatings with VOC levels at or below 100 g/l.

2. Issue: The 100 g/l limit for flat coatings will allow the sale of medium quality coatings, but consumers will not be able to purchase high quality flats that will stand up to repeated washings or have good exterior durability. Application properties at lower temperatures will be compromised, as will freeze-thaw resistance.

Response: Our survey of product information indicates that a variety of manufacturers have been able to use available technology to achieve desirable properties for flat coatings with VOC levels at or below 100 g/l. Our survey indicates that there are a number of existing interior and exterior coatings that meet the proposed limit that are marketed as premium quality coatings. Further, the product information indicates that there are complying coatings with excellent scrub resistance and durability. Also, there are complying products that allow for low temperature application and products with good freeze-thaw resistance.

3. Issue: It is premature to adopt SCAQMD's interim flat limit when the District

committed in Rule 1113 to do a technical assessment prior to its 2001 implementation date.

Response: SCAQMD Rule 1113 requires the District to perform the first technology assessment on flat coatings by July 1, 2000, a year before the 100 g/l limit is to take effect in that district. We expect that the SCAQMD's assessment will largely consider the same types of information that we considered in our assessment, i.e. information obtained in ARB's 1998 survey and specific product information. We will monitor the SCAQMD's work in this area, and if their assessment indicates a need to reconsider the 100 g/l limit for flat coatings, there will be sufficient time for the other California districts to make any necessary rule changes before the recommended effective date.

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2. Non-Flat Coatings

Product Category Description:

Non-flat coatings are low gloss to high gloss coatings that are widely used on both interior and exterior surfaces of residential and commercial buildings. They are defined as having a gloss of 15 or greater on an 85^{o} meter and 5 or greater on a 60^{o} meter. For the purposes of the 1998 ARB Architectural Coatings Survey, this category has been divided into three subcategories: low gloss, medium gloss, and high gloss. Please note that the distinction made among the three subcategories is only for the purpose of presenting information; separate VOC limits are not being proposed for the different subcategories. Non-flat coatings are often described using terms such as "eggshell," "satin," "semi-gloss," and "enamel." Quick-dry enamel coatings are also non-flat coatings, but are treated as a separate category for which we are proposing a higher VOC limit (see the "Quick-Dry Enamel" category description). Non-flat coatings tend to resist stains better than flat coatings and tend to be more washable. The greater shine of non-flat coatings may show surface flaws more than flat coatings.

Tables D-3a-c below summarize our estimates of sales and VOC emissions from the non-flat coatings category based on the ARB survey results. The 1998 ARB survey shows that each of the three subcategories of non-flat coatings has a large California sales volume. Medium gloss coatings, with 18 percent of the sales volume, is the second largest coating subcategory behind flat coatings. Low gloss coatings is the fifth largest subcategory, with 5 percent of the sales volume. High gloss coatings is the ninth largest subcategory, with 2 percent of the sales volume (ARB, 1999).

With regard to VOC emissions, non-flat coatings emit approximately 11 tons per day in California, excluding emissions in the SCAQMD. The 1998 ARB survey found that the medium gloss subcategory has the third highest emissions of all the coatings categories, representing 12 percent of the total VOC emissions from architectural coatings. High gloss coatings contribute 4 percent of the architectural coatings emissions and are the eighth highest subcategory. Low gloss coatings represent three percent of architectural coatings emissions. For low and medium gloss coatings, most of the emissions are from water-based products, in spite of the relatively lower VOC content of those products, because the great majority of the products sold are water-based. However, for high gloss coatings, emissions are more evenly split among solvent-based and water-based products, with emissions from solvent-based products somewhat greater than those from water-based products (ARB, 1999).

Table D-3a
Non-Flat Coatings – Low Gloss*

	Number of Products	Category Sales (gallons/year)	Sales-Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	30	34,373	341	0.07
Water-Based	821	4,440,720	133	1.65
Total	851	4,475,094	134	1.73

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.

Table D-3b
Non-Flat Coatings – Medium Gloss*

	Number of Products	Category Sales (gallons/year)	Sales-Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	246	522,186	287	0.94
Water-Based	1,893	15,107,606	151	5.80
Total	2,139	15,629,792	155	6.75

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.

Table D-3c
Non-Flat Coatings – High Gloss*

	Number of Products	Category Sales (gallons/year)	Sales-Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	463	532,033	366	1.23
Water-Based	333	1,618,786	209	0.94
Total	796	2,105,818	248	2.17

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.

Product Use and Marketing:

Typically, non-flat coatings can be brushed, rolled, or sprayed on the surface to be painted. "Do-it-yourselfers" and paint contractors can purchase non-flat coatings at outlets including hardware stores, home supply stores, and retail paint stores. Non-flat coatings are commonly used on surfaces where frequent cleaning is necessary and in rooms where moisture is present. Kitchens, bathrooms, hallways, and children's rooms are often painted with non-flat coatings. Commercial buildings and institutions commonly use non-flat coatings on surfaces such as walls, corridors, and stairwells. Doors, window frames, shutters, and wood trim are typically painted with non-flat coatings. With proper surface preparation and priming (if necessary), non-flat coatings can be used on a large variety of interior and exterior substrates including drywall, plaster, concrete block, wood, and metal. Most low gloss and medium gloss coatings (94 percent for each subcategory) are sold in size units greater than one liter. Proportionately less (88 percent) high gloss coatings are sold in size units greater than one liter (ARB, 1999).

The 1998 ARB survey showed that about 44 percent of the low gloss coatings sold in 1996 were formulated for interior applications, 23 percent for exterior applications, and 32 percent were formulated for both interior and exterior applications. For medium gloss coatings, about 48 percent were formulated for interior applications, 12 percent for exterior applications, and 40 percent were formulated for both interior and exterior applications. For high gloss coatings, about 36 percent were formulated for interior applications, 15 percent for exterior applications, and 48 percent were formulated for both interior and exterior applications (ARB, 1999).

For marketing their products, some manufacturers of "zero VOC" non-flat coatings emphasize the health benefits of using such coatings versus conventional coatings. The benefits include the low-to-minimal odor of zero VOC coatings and the reduced chemical exposures from the use of such coatings. Because of those features, manufacturers of zero VOC coatings emphasize the coatings' suitability for use in enclosed centrally-ventilated buildings (e.g. schools, office buildings, and hospitals), rooms that need to be occupied soon after painting (e.g. restaurants, hotel rooms), and residences.

Product Formulation:

As mentioned above, most low gloss coatings are water-based. The 1998 ARB survey (which reflected 1996 sales) shows that water-based low-gloss coatings represent about 99 percent of the market for that subcategory. Solvent-based low gloss coatings represent about one percent of the market. The sales volume of solvent-based low gloss coatings has decreased approximately 60 percent since the 1993 ARB survey of architectural coatings (which reflected 1990 sales), while overall sales of low gloss coatings increased 7 percent over the same period. The overall sales-weighted average VOC content of low gloss coatings decreased 18 percent between 1990 and 1996 (ARB, 1999).

Similarly, most medium gloss coatings are water-based, but the proportion of solvent-based sales is somewhat greater than that of low gloss coatings. The 1998 ARB survey shows that water-based medium gloss coatings represent about 97 percent of the market for that

subcategory. Solvent-based medium gloss coatings represent about three percent of the market. The amount of solvent-based medium gloss coatings sold has decreased approximately 65 percent since the 1993 ARB survey, while overall sales of medium gloss coatings has increased 11 percent over the same period. The overall sales-weighted average VOC content of medium gloss coatings decreased 12 percent between 1990 and 1996 (ARB, 1999).

As the gloss level increases, the proportion of solvent-based products increases as well. However most high gloss coatings are water-based. Water-based products represent about 75 percent of the market and solvent-based products represent about 25 percent of the market for this subcategory. The amount of solvent-based high gloss coatings sold has decreased approximately 64 percent since the 1993 ARB survey of architectural coatings, while overall sales of high gloss coatings has increased 46 percent over the same period. The overall sales-weighted average VOC content of high gloss coatings decreased 17 percent between 1990 and 1996 (ARB, 1999).

As discussed for flat coatings, the type of binder used in a formulation generally has a large influence on the amount of VOC needed. Binders serve to hold the paint together in a film and to provide adhesion to the substrate. The solvent-based coatings in this category are commonly formulated using alkyd resins as binders. The binder in water-based non-flat coatings is typically a dispersion of synthetic resin particles, called latex. Thus, these types of coatings are commonly called latex coatings. A wide variety of synthetic polymers are used as binders in latex coatings. Two common latex binders are acrylic and vinyl-acrylic resins. As the gloss level of paint increases, the relative amount of binder as compared to other solid ingredients (i.e. pigment) also tends to increase.

The VOCs in water-based coatings perform one or more of the following functions: binder coalescing aid, polymer plasticizer, freeze/thaw stabilizer, defoamer, and carriers for other additives such as colorants, thickening agents, surfactants, and biocides. The largest contributors of VOCs in latex coatings are glycols, added mainly to provide freeze/thaw resistance, and coalescing solvents such as 2,2,4-trimethyl-1,3-pentanediol isobutyrate (Texanol®), to allow the latex particles to come together to form a film (Klein, 1993). Generally, so called “zero VOC” coatings contain very small amounts of VOCs. Lower-VOC coatings tend to be formulated using binders that require less coalescing solvent and/or are formulated using less VOCs for freeze/thaw stabilization (Klein, 1993; Currie, 1993).

Proposed VOC Limit and Basis for Recommendation:

We recommend a 150 g/l VOC limit for non-flat coatings, effective January 1, 2003. The proposed VOC limit is technologically and commercially feasible by January 1, 2003, based on our review of ARB survey data on market shares, product information from manufacturers, laboratory performance tests, and information on available resin technology as discussed below. The proposed limit is lower than the national limit recently promulgated by the U.S. EPA for this category. The U.S. EPA divides non-flat coatings into interior and exterior categories, but the same VOC limit, 380 g/l, applies to both (U.S. EPA, 1998). In California, the 1989 SCM for architectural coatings recommended a 250 g/l VOC limit for non-flat coatings (ARB, 1989); this is the most common limit currently in effect for those California air pollution control districts that have architectural coatings rules. In 1999, the SCAQMD adopted a 150 g/l limit for non-flat

coatings that will become effective July 1, 2002, and also adopted a 50 g/l limit that will become effective July 1, 2006. Our recommended limit is consistent with the interim limit adopted by the SCAQMD.

As shown in Table D-4a, the 1998 ARB survey found that about 76 percent of the market share of low gloss coatings comply with the proposed VOC limit. About 470 of the 850 products reported comply with the proposed limit. Of the 29 companies that reported for this subcategory, 22 offered low gloss coatings that comply with the proposed limit. A number of low gloss products have a VOC content lower than the proposed limit. Products with a VOC content equal to or lower than 100 g/l represent about 19 percent of the market. Products with a VOC content equal to or lower than 50 g/l represent about 4 percent of the market (ARB, 1999).

As shown in Table D-4b, the 1998 ARB survey found that about 57 percent of the market share of medium gloss coatings comply with the proposed VOC limit. About 810 of the 2,100 products reported comply with the proposed limit. Of the 50 companies that reported for this subcategory, 28 offered medium gloss coatings that comply with the proposed limit. A number of medium gloss products have a lower VOC content than the proposed limit. Products with a VOC content equal to or lower than 100 g/l represent about 23 percent of the market. Products with a VOC content equal to or lower than 50 g/l represent about 2 percent of the market (ARB, 1999).

As shown in Table D-4c, the 1999 ARB survey found that about 3 percent of the market share of high gloss coatings comply with the proposed VOC limit. An additional 33 percent of the market is within 50 g/l above the limit (i.e., sales of products at a VOC level of 200 g/l or lower represent 36 percent of the market). About 50 of the 800 products reported comply with the proposed limit. Of note is that 21 percent of the sales in this subcategory are for products with VOC levels above 250 g/l, which is the VOC limit in those districts that have architectural coatings rules. About a third (29 percent) of the sales of the high VOC products are for liter or smaller size units, which are exempt from district VOC limits. Of the 34 companies that reported for this subcategory, eight offered high gloss coatings that comply with the proposed limit. Ten products with a VOC content equal to or lower than 100 g/l were identified (ARB, 1999).

Tables D-4a-c also show that VOC emission reductions in the non-SCAQMD portion of California would be approximately 0.11, 1.06, and 0.33 tons per day for low, medium, and high gloss coatings, respectively, (1.5 tons per day total) on an annual average basis, from implementing the proposed limit of 150 g/l.

Table D-4a
Low Gloss Non-Flat Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
150	472	75.7	0.11

* Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Table D-4b
Medium Gloss Non-Flat Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
150	805	57.3	1.06

* Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Table D-4c
High Gloss Non-Flat Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
150	46	2.6	0.33

* Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

The following discussion distinguishes between products formulated for interior versus exterior use. The 1998 ARB survey indicates that 62 percent of the volume of interior low gloss coatings sold comply with the proposed limit, 94 percent of exterior low gloss coatings comply, and 83 percent of low gloss coatings sold for both interior and exterior use already comply. Those market shares represent 167 products, 196 products, and 56 products, respectively (ARB, 1999).

Similarly, 58 percent of the volume of interior medium gloss coatings sold comply with the proposed limit, 70 percent of the exterior medium gloss coatings comply, and 53 percent of the medium gloss coatings sold for both interior and exterior use already comply. Those market shares represent 383 products, 268 products, and 112 products, respectively (ARB, 1999).

The proportions of interior, exterior, and dual interior/exterior high gloss coatings that comply with the proposed limit follow the same general pattern as seen above for low and medium gloss coatings. Thus, a greater proportion of the exterior high gloss products surveyed complies with the proposed limit when compared with interior and dual interior/exterior high gloss products. Because less than three companies reported sales of exterior high gloss products with VOC levels of 150 g/l or less, data from that subcategory are protected and cannot be broken out in any more detail (ARB, 1999).

The high market share that complies with the proposed VOC limit in the low and medium gloss subcategories demonstrates widespread use of existing low VOC technology for those product types. While the complying market share for high gloss products is lower, some products that comply with the proposed limit are being marketed, and resin technologies for high gloss products are continuing to advance (see discussion below).

Most of the existing non-flat coatings with a VOC level of 250 g/l or less (the most common current limit for those districts that have architectural coatings rules) are water-based latex products, although some solvent-based products are at or below that limit (ARB, 1999). To meet the proposed VOC limit, it is likely that most solvent-based non-flat coatings would need to be reformulated to be water-based, and that noncomplying water-based products would need to be reformulated using lower VOC technology. As discussed above, the primary sources of VOCs in latex coatings are coalescing solvents and VOCs (glycols) added mainly to provide freeze/thaw resistance. We expect that product reformulation of water-based latex products to meet the proposed limit would involve switching to a binder (or blend of binders) that requires less coalescing solvent and/or reducing the amount of glycol that is added to provide freeze/thaw stability (Klein, 1993, Currie, 1993).

Laboratory performance tests

National Technical Systems. Independent laboratory performance tests of a number of coatings were recently conducted by National Technical Systems (NTS) under contract with the SCAQMD. Included in those tests were 14 interior and 13 exterior non-flat coatings. Of those coatings, 9 had a VOC content below 150 g/l (range: 0 to 135 g/l), 10 had a VOC content at or below 250 g/l (range: 170 to 250 g/l) and the remaining 8 had VOC levels that ranged from 400 to 420 g/l. The coatings with VOC levels of 400 g/l or greater were mostly "quick-dry enamels," and the test results for those coatings are discussed in the Quick-Dry Enamel category description. For this discussion, those coatings that comply with the proposed 150 g/l limit ("lower VOC coatings") are compared with those coatings with a VOC content above 150 g/l that comply with the most common current limit of 250 g/l ("higher VOC coatings"). Similar performance was seen in tests of brushing properties, sag resistance, and hiding. Dry-to-touch times were also similar, but dry hard times tended to be somewhat shorter for lower VOC coatings. The lower VOC coatings tended to have slightly less leveling performance than the higher VOC coatings, but this difference was mostly seen with the 0 VOC coatings. Dry film thickness tended to be slightly higher in the lower VOC coatings. Resistance to blocking was similar for the interior coatings, while resistance to blocking for the exterior coatings tended to be better in the lower VOC product group. Interior coatings were also tested for dirt removal ability and scrub abrasion resistance, where the higher VOC coatings tended to perform somewhat better (NTS, 1999).

NTS also tested primer/topcoat systems with non-flat coatings as topcoats. Included in those tests were 14 interior and 12 exterior systems with non-flat topcoats. Of those topcoats, 11 had a VOC content below 150 g/l (range: 0 to 135 g/l), 9 had a VOC content at or below 250 g/l (range: 220 to 250 g/l) and the remaining 6 had a VOC level of 400 g/l. ARB staff compared the results for those topcoats that comply with the proposed 150 g/l VOC limit with those topcoats with VOC levels greater than 150 g/l but less than or equal to 250 g/l. Our comparison indicates that lower and higher VOC interior systems had comparable performance with regard to adhesion

tests and resistance to household chemicals. However, the lower VOC topcoat systems tended to show slightly more softening in response to chemical exposure. The exterior systems showed similar performance with regard to dry film thickness and water resistance (NTS, 1999).

Harlan Associates. In 1995, Harlan Associates, Inc., under contract with ARB, conducted performance tests on 10 interior and 10 exterior non-flat coatings. Those coatings were selected in 1994 from commercially available coatings. The VOC levels of the twenty coatings ranged from 15 g/l to 459 g/l. Thirteen were high gloss coatings, six were medium gloss, and one was low gloss. Four of those coatings, 3 interior (medium gloss) and 1 exterior (low gloss), had VOC levels below 150 g/l. The low VOC non-flat coatings were similar to higher VOC coatings with regard to stability, hardness, application, and appearance. Results of tests for adhesion showed that two low VOC coatings had good to excellent adhesion, while two had poor to mediocre adhesion. In comparison, many of the higher VOC coatings had good to excellent adhesion, while two of those coatings rated "poor" to "fail" on the adhesion test. One low-VOC coating failed the block resistance test (the resistance of two painted surfaces to stick to each other), two rated "good" to "very good", and one rated "excellent." In comparison, the higher VOC coatings rated "fail" to "excellent" in block resistance. One low VOC coating failed the flexibility test, while all the other coatings passed. Two low VOC coatings (only interior coatings tested) passed the scrub resistance test, while one wore through at 400 cycles. In comparison, five of the higher VOC coatings passed the scrub resistance test, while two wore through sooner than 400 cycles (ARB, 1995; Cowen, 1999).

Product information from manufacturers

Product information sheets published by coatings manufacturers indicate that a variety of low to medium gloss coatings that meet the proposed VOC limit are available that possess performance characteristics similar to higher VOC coatings. The sample size for low VOC high gloss coatings is much smaller, but suggests that some performance characteristics of low VOC coatings are comparable to those of higher VOC coatings. At the end of the discussion of this category are tables of information about specific products that meet the proposed VOC limit and, for comparison, products that exceed the proposed limit. We were able to identify specific products with a VOC content of 150 g/l or less from brands that include AFM, Con-Lux, Dunn Edwards, Evr-Gard, Flex Bon, Griggs Paint, ICI Dulux, Kelly-Moore, Sherwin Williams, and Spectra-Tone.

A list of performance characteristics compiled from product information sheets for non-flat coatings with VOC levels of 150 g/l or less is presented below. The compilation groups low and medium gloss products together (often described as satin, eggshell, or semi-gloss finishes) but distinguishes those products from high gloss products. The compilation further distinguishes between interior and exterior products; characteristics of coatings formulated for dual interior/exterior use are included under both categories. Please note that not all non-flat coatings with VOC levels at or below 150 g/l possess all of the characteristics listed below:

Low and medium gloss interior coatings
professional best, premium quality, highest quality premium
good to excellent adhesion
excellent moisture resistance
excellent one coat coverage
alkyd-like flow and leveling
very good block resistance
easy application, high speed application
highly durable finish, extremely abrasion resistant
excellent color retention
stain resistant
excellent washability
bonds to glossy surfaces
very good touch-up properties
good dry hide, excellent hide
mildew resistant
non-yellowing
smooth, rich finish
high build

High gloss interior coatings
professional best line
excellent hide
good adhesion
durable, extremely abrasion resistant
extremely washable
smooth, rich finish
equal to alkyd enamels for flow and leveling characteristics
non-yellowing

Low and medium gloss exterior coatings
Professional best, best quality, premium quality, highest quality premium
superior durability, durable and tough, outstanding exterior durability
extremely abrasion resistant
extremely washable
superior color retention, excellent color and gloss retention
superior to exceptional mildew resistance
flexible
exceptionally smooth finish
superior hiding
shields the surface from the elements that cause film failure (grain crack, peeling, blistering), resists blistering, peeling and flaking
exceptional weathering resistance
fade and chalk resistant
moisture resistant
excellent adhesion

easy application
long lasting uniform finish
recommended for use down to a surface and air temperature of 35^{o} F

High gloss exterior coatings
best quality
outstanding exterior durability
extremely abrasion resistant
extremely washable
superior block resistance
superior moisture resistance
superior gloss retention
superior flow and leveling

Available resin technology

The SCAQMD recently surveyed current and emerging technology available for formulating non-flat coatings. ARB staff concurs with the findings of the SCAQMD based on our own discussions with resin manufacturers. The SCAQMD identified a number of resin manufacturers that have developed technologies for use in developing non-flat coatings, high-gloss coatings in particular, that comply with the proposed limit. Technologies identified by the SCAQMD include those offered by Rohm and Haas, BASF, Conlux, and Vianova Resins (SCAQMD, 1999).

One performance characteristic that is important for non-flat coatings is block resistance, especially for situations where two painted surfaces come in contact with each other, such as on doors and windows. Block resistance tends to be a challenge for high-gloss coatings in particular because high gloss coatings tend to have greater proportions of resin binder in relation to other solid ingredients (such as pigment) than lower gloss coatings. Generally, the low-VOC resins tend to be softer and thus tend to stick to each other more, potentially affecting block resistance. Of the two independent laboratory studies discussed above, only the NTS study tested a high gloss coating with a VOC level that complies with the proposed 150 g/l limit. The low VOC exterior coating tested by NTS showed fair block resistance (rating a "3" versus a range of ratings from "0" to "12" for the higher-VOC exterior coatings tested, with a higher number indicating better performance). At least two resin companies are currently offering products for use in formulating high-gloss coatings that show good block resistance properties at low VOC levels (SCAQMD, 1999; BASF, 1999, Vianova Resins, 1999).

Issues:

1. Issue: The non-flat coatings category covers a broad range of products. The ARB should consider subcategorizing the non-flat coatings category to allow for a higher VOC limit for special use, high performance products. Two specific suggestions are to split the non-flat

coatings category into interior and exterior subcategories, and to further split these subcategories into a high-gloss subcategory and another subcategory for the remaining non-flat coatings. A VOC limit of 250 g/l was suggested for the high gloss subcategory.

Response: Our survey of product information published by paint manufacturers indicates that a wide variety of interior and exterior product types in the non-flat coatings category comply with the proposed limit. This includes coatings formulated for contractors (which emphasize features such as ease and speed of application, hiding properties, and touch-up properties), high-build coatings, coatings designed for low temperature application, and premium quality coatings.

We distinguished between interior and exterior non-flat coatings in our evaluation, and also distinguished between low, medium, and high gloss coatings. As discussed above, information on market shares obtained from the ARB survey indicates that a considerable portion of existing interior and exterior low and medium gloss coatings already comply with the proposed limit. Our survey of product information sheets for complying low and medium gloss coatings shows that a variety of performance characteristics comparable to those of higher VOC products have been achieved for both interior and exterior coatings. Thus, available information does not support subdividing low and medium gloss coatings into interior and exterior subcategories.

In addition, available evidence does not support the creation of a separate subcategory for high gloss coatings. While the market share for high gloss coatings that comply with the proposed limit is lower than the corresponding market shares for low and medium gloss coatings, technology for formulating complying high gloss coatings is available from some resin manufacturers and is being developed by other manufacturers. We believe that the proposed effective date of January 1, 2003, will allow sufficient time for the formulation of complying high gloss products that are comparable to higher VOC products over a broad range of performance characteristics.

2. Issue: The 150 g/l limit for non-flat coatings will adversely affect a number of performance characteristics of those coatings. Characteristics that will be compromised include film durability, scrub resistance, stain removal properties, low temperature application properties, freeze-thaw resistance, and block resistance.

Response: Our survey of product information sheets indicates that there are a number of complying interior and exterior low and medium gloss coatings that are identified by their manufacturers as premium quality coatings. Further, the product information indicates that there are complying coatings with excellent durability, washability, and abrasion resistance. Also, there are complying products that allow for low temperature application and products with very good block resistance. Available information also suggests that the 150 g/l limit allows for the formulation of non-flat coatings with sufficient freeze-thaw resistance. Our survey of product information indicates that a variety of manufacturers have been able to use available technology to achieve a balance in desirable properties for low and medium gloss coatings with VOC levels at or below 150 g/l. Also, as discussed above, the proposed effective date of January 1, 2003, will allow sufficient time for the formulation of high gloss products with a VOC content of 150 g/l that are comparable to higher VOC products over a broad range of performance characteristics.

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United States Environmental Protection Agency, "Final Rule: National Volatile Organic Compound Emission Standards for Architectural Coatings," 40 CFR part 59, subpart D, 63 FR 48848, September 11, 1998. (U.S. EPA, 1998)

Vianova Resins, Technical Update, "High Gloss Enamels with RESYDROL®, Acrylic-Modified Alkyd Emulsions that Exceed Traditional Alkyd Performance." (Vianova Resins, 1999)

3. Antenna Coatings

Product Category Description:

Antenna coatings are primers or topcoats designed for application to equipment and associated structural appurtenances that are used to receive or transmit electromagnetic signals. For example, these coatings are used on the satellite dishes and supporting structures used by the National Radio Astronomical Observatory (NRAO) and the National Aeronautics and Space Administration (NASA). The coatings are designed to minimize signal losses while protecting the antenna's metal surfaces from corrosion. These products should produce thin films, to avoid losses in signal strength, and should also scatter infrared waves, to avoid generating excess heat at the antenna's receiver (Triangle Coatings, 10/18/99).

We are proposing to add a new category for antenna coatings in the SCM. These coatings are not regulated in district architectural coatings rules as a separate category (but instead are subject to the industrial maintenance category). However, as explained below, we believe that a new category and VOC limit for these products is justified. In addition, the U.S. EPA's national architectural coatings rule contains a separate category and VOC limit for these products.

No antenna coatings were reported in the ARB's 1998 Architectural Coatings Survey. However, one manufacturer subsequently provided sales volumes in California, and VOC content information, indicating that these products contribute VOC emissions less than 0.01 tons per day statewide, excluding the SCAQMD.

Product Use and Marketing:

Antenna coatings are highly specialized paints used exclusively to paint satellite dishes and related equipment, and are not available to the general public. As mentioned above, the dry film thickness should be as thin as possible while still providing corrosion protection. As such, it may be necessary to completely remove all old coatings during repainting operations. Some antenna operators have developed detailed procedures that painting contractors must follow regarding surface preparation and painting application techniques (JPL, 2/15/96).

Product Formulation:

We are only aware of one manufacturer of antenna coatings. This manufacturer currently produces: (1) a solvent-based zinc chromate primer and a solvent-based flat white topcoat (Triangle No. 6), for reflective surfaces; and (2) a solvent-based glossy white topcoat (Triangle No. 710) for nonreflective surfaces, such as the antenna's supporting structures. This manufacturer has also developed a solvent-based acrylic-urethane replacement for the primer/topcoat system for reflective surfaces that does not require a primer. This system reportedly has superior performance with respect to the minimization of signal losses compared to the existing system (Otoshi, 11/15/99). Due to confidentiality concerns, we cannot reveal further details about these formulations.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 530 g/l VOC limit for antenna coatings, effective January 1, 2003. This VOC limit is consistent with the U.S. EPA's national architectural coatings rule. This limit is clearly technologically and commercially feasible because the proposed limit would essentially cap the VOC content of existing products, and would not require reformulation of existing products or result in emission reductions. We believe this proposed VOC level is appropriate because we are not aware of any lower VOC products, or existing technology that would allow for compliance with a lower VOC limit. In addition, lower VOC prototype water-based formulations that have been tested by the Jet Propulsion Laboratory have resulted in greater signal losses compared to existing solvent-based formulations (Otoshi, 8/15/99; Otoshi, 11/15/99; JPL, 12/7/99). The existing products have been extensively tested by the Jet Propulsion Laboratory, and are used by NASA and the NRAO in other antenna installations outside of California. Finally, as mentioned above, the emissions from these products are less than 0.01 tons per day statewide, excluding the SCAQMD.

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Jet Propulsion Laboratory. Telephone conversation with ARB staff. December 7, 1999. (JPL, 12/7/99)

Triangle Coatings. Telephone conversation with ARB staff. October 18, 1999. (Triangle, 10/18/99).

4. Antifouling Coatings

Product Category Description:

Antifouling coatings are products designed for application to submerged stationary structures and their appurtenances to prevent or reduce the attachment of marine or freshwater biological organisms. We are proposing to add a new category for these coating products in the SCM. As defined in the U.S. EPA's national architectural coatings rule, these coatings may or may not be registered with the U.S. EPA as a pesticide. However, we are proposing that they be registered as a pesticide to qualify as an antifouling coating in this proposed SCM, consistent with district marine coatings regulations in California. Antifouling coatings are typically used on underwater structures such as docks, sea walls, oil drilling platforms, piers, and boat slips.

As shown in Table D-5 below, the antifouling coatings that were reported in the ARB's Architectural Coatings Survey are solvent-based coatings with a sales-weighted average VOC content of 351 g/l. These coatings resulted in less than 0.01 tons per day of VOC emissions statewide in 1996, excluding the SCAQMD. Information on sales volumes cannot be provided for this category because not enough products were reported to protect data confidentiality.

Table D-5
Antifouling Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	PD	PD	351	~0.00
Water-Based	0	0	N/A	N/A
Total	PD	PD	351	~0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

PD = Protected data.

Product Use and Marketing:

Antifouling coatings, as defined in this proposed SCM, are highly specialized coatings that are also registered pesticides. According to one manufacturer, these products are not generally produced exclusively for submerged architectural structures (Hempel, 12/22/99). Instead, these products are designed primarily for marine vessels, but may also be used on architectural structures. These products are often used by shipbuilders, original equipment manufacturers, and large construction firms (in architectural coatings applications).

Product Formulation:

Due to the limited number of respondents to the ARB's Architectural Coatings Survey, we cannot reveal detailed information about the formulations of antifouling coatings. Based on the ARB survey data, these are solvent-based formulations. Antifoulant coatings in general

release cuprous oxide or tributyl tin as the active ingredient that prevents the attachment of biological organisms.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 400 g/l VOC limit for antifouling coatings, effective January 1, 2003. This VOC limit is slightly lower than the 450 g/l VOC limit in the U.S. EPA's national architectural coatings rule. However, this limit is clearly technologically and commercially feasible because it effectively places a cap on the VOC content of existing products sold in California, as reported in the ARB's Architectural Coatings Survey. The proposed limit would not require reformulation of existing products or achieve emission reductions. We believe the proposed 400 g/l VOC limit is appropriate because it is consistent with the VOC limits for antifouling coatings in California's district marine coatings rules, with the exception of the San Diego Air Pollution Control district's 330 gram/liter VOC limit for pleasure craft (SCAQMD; SDAPCD; and BAAQMD). The antifouling coatings used for architectural coatings applications are generally the same as those subject to marine coatings rules. We also note that there were no products reported in the ARB's Architectural Coatings Survey that would meet the 250 g/l VOC limit for industrial maintenance coatings, which is generally the category these products would otherwise fall under. Finally, as mentioned above, the emissions from these products are less than 0.01 tons per day statewide, excluding the SCAQMD.

Table D-6
Antifouling Roof Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%)	Emission Reductions (excluding South Coast AQMD) (tons/day)
400	PD	100	0

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
PD = Protected data.

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Hempel Coatings. Telephone conversation with ARB staff. December 22, 1999. (Hempel, 12/22/99)

San Diego County Air Pollution Control District. Rule 67.18, Marine Coating Operations. Revised May 15, 1996. (SDAPCD)

SCAQMD. Rule 1106, Marine Coating Operations. Amended January 13, 1995.

5. Bituminous Roof Coatings

Product Category Description:

Bituminous roof coatings are products labeled as and formulated for roofing that incorporate bitumens. Bitumens are black or brown materials including, but not limited to, asphalt, tar, pitch, or asphaltite that are soluble in carbon disulfide, consist mainly of hydrocarbons, and are obtained from natural deposits or as residues from the distillation of crude petroleum or coal.

Table D-7 below summarizes our estimate of sales and VOC emissions from the bituminous coatings category.

Table D-7
Bituminous Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	117	1,295,827	225	1.38
Water-Based	34	3,623,800	3	0.04
Total / Overall	151	4,919,627	37	1.42

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

When we conducted the 1998 ARB survey, we included U.S. EPA's category of bituminous coatings. The data shown above therefore represent pavement sealers, bituminous primers, bituminous roof coatings and some industrial maintenance coatings. After further analysis of survey responses and discussions with several roof coating manufacturers, we learned that many of the coatings with VOC contents less than 50 g/l are pavement sealers. For the purposes of this proposed SCM, we are limiting this category to bituminous coatings that are applied only to roofs, including bituminous roof primers.

Product Use and Marketing:

Bituminous roof coatings are applied at ambient temperatures (cold-applied) and, when the carrier evaporates, produce a cured water-resistant film. These products are marketed as economical products that are easy to use, non-flammable and offer product variety and versatility. Bituminous roof coatings can be found in most local hardware stores. (RCMA, undated)

Product Formulation:

Traditional bituminous roof coatings are gelled coatings made from refined bitumens, petroleum solvents, clay fillers, surfactants, fibers, fillers and optional reflective pigments. Cutback bitumens are made through a process of refining the distillate bitumens through vacuum distillation or oxidation to produce various physical properties and then dissolving them in a petroleum solvent. (RCMA, undated)

Bitumens may also be emulsified in water. Emulsification allows the bitumens to be uniformly suspended in the water. As with the petroleum solvents, the film is formed when the carrier (water) evaporates from the coating. In addition, there are roof coatings that use a combination of an acrylic or elastomeric (non-bituminous) roof coating and asphalt or coal tar (bituminous) roof coatings. (RCMA, undated)

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit of 250 g/l is technologically and commercially feasible by the January 1, 2003, effective date based on a combination of the following factors: high complying market share; and clarifying data provided by the Roof Coatings Manufacturers Association (RCMA).

The high complying market share with the proposed VOC limit reflects the fact that the survey data are predominated by very low VOC water-based products (asphalt emulsions). However, after a detailed review of the survey data we also noted several solvent-borne bituminous roof coatings, primers and flashing cements with substantial sales that meet the proposed 250 g/l limit. Subsequent to the ARB survey, the RCMA supplied us with supplemental data gathered from a survey they conducted. These data showed that all of the water-based products can comply with our proposed limit and that 99 percent of the solvent-based products either meet or are within 50 g/l of the proposed limit. Based upon an analysis of our survey data and the supplemental survey data provided by RCMA, we are recommending a limit of 250 g/l. This is consistent with the SCAQMD limit for bituminous roof coatings, which goes into effect in 2002.

We are proposing to include bituminous roof primers in this category. Bituminous roof primers, in most districts, are currently subject to the primers, sealers, and undercoaters category limit. For approximately ten years, the districts have regulated this coating category at a 350 g/l VOC limit. There are several complying products, which have been on the market for several years. We believe that with modifications to formulations, the remaining market share of bituminous primers can meet the 250 g/l VOC limit.

The proposed VOC limit would not apply to all types of bituminous products. For example, bituminous pavement sealers are subject to the proposed VOC limits for flats/nonflats, and those bituminous coatings that are used in industrial maintenance situations are subject to the proposed limit for the industrial maintenance coatings category. Bituminous aluminum roof

coatings would be considered metallic pigmented coatings, assuming such coatings meet the

metallic pigmented coating definition. Table D-8 represents our estimates of the emission reductions from the proposed VOC limit.

Table D-8
Bituminous Roof Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%)	Emission Reductions (excluding South Coast AQMD) (tons/day)
250	101	97.6	0.01

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Issues:

1. Issue: The 250 g/l limit for bituminous coatings is technically infeasible.

Response: We believe the proposed 250 g/l is technically feasible based upon a detailed analysis of our survey data and the data submitted by industry. Nearly ninety-eight percent of the bituminous coating market currently complies with the proposed 250 g/l limit. Manufacturers of non-complying products will have until 2003 to comply. We will work with the affected industry to assess their progress towards meeting the proposed limit by conducting a technology assessment prior to the effective date.

2. Issue: The data collected in the 1998 Architectural Coatings Survey are incomplete and represent a fraction of the products manufactured and shipped into California.

Response: As discussed above, we have worked with the roof coatings industry to supplement the survey data for this category.

3. Issue: The performance characteristics of solvent-based roof and flashing cements and adhesives are inherently different from water-based bituminous coatings (emulsions), and are not necessarily substitutes for one another.

Response: Our survey data show that there are solvent-based bituminous roof and solvent-based bituminous flashing cement products that meet the proposed 250 g/l limit. Most roof adhesives would not be subject to the proposed VOC limit, since the districts regulate roof adhesives in their adhesive rules.

4. Issue: If patching materials are included in the proposal, we recommend a 400 g/l VOC limit for wet and dry patching material, and a 50 g/l limit for all other patching material. Emulsion-based patching materials cannot be applied in wet conditions to immediately stop a leak, where the solvent-based and dry material can.

Response: Most patching materials are regulated in the adhesive and sealant rules by the local air districts. See local district rules for current limits.

5. Issue: Industry needs the solvent-based mastics at the 250-300 g/l limit in the

SCAQMD's Rule 1113. We cannot make a bituminous primer that meets the current 350 g/l VOC limit. There are three main problems with the 350 g/l products: the viscosity is too heavy, they don't dry, and you can't put an emulsion over them. Previously, these coatings were around 500 g/l.

Response: Bituminous roof primers in most districts are subject to the primers, sealers, and undercoaters category. For approximately ten years, the districts have regulated this coating category at the 350 g/l VOC limit. There are several complying products, which have been on the market for many years. We believe that with modifications to formulations, bituminous primers can meet the 250 g/l VOC limit. As the effective date approaches, we will work with the affected industry to assess their progress towards meeting the proposed limit, by conducting a technology assessment.

6. Issue: There is a problem with the definitions of roof and bituminous coatings. They were not adequately distinguished as they were in the National Rule. We would like to see no lower limits for these categories than those limits in the SCAQMD.

Response: The ARB staff met with roof and bituminous coating manufacturers to clarify these definitions. We also worked with the RCMA to gather additional data. As discussed above, we believe the proposed 250 g/l limit is feasible.

7. Issue: We provided data on the performance of two coatings: a 250 g/l bituminous coating, and a 300 g/l bituminous coating. Note the differences in the viscosity of these coatings, especially at lower temperatures.

Response: Please see response to Issue 1.

8. Issue: The proposed 250 g/l limit is precisely half of the limit permitted in the national rule (500 g/l for bituminous coatings). The proposed SCM should include a category for bituminous roof primers with a VOC content limit of 500 g/l.

Response: Please see response to Issue 1.

9. Issue: The 250 g/l VOC level for bituminous coatings, as currently proposed, is too low for these products. We request that bituminous coatings be regulated at 300 g/l at a minimum. We request a category for bituminous primers. If regulated under the primers, sealers, and undercoaters category, a 200 g/l VOC limit would ban these products.

Response: Please see response to Issue 1.

10. Issue: We are requesting the VOC level for bituminous coatings be no less than 300 g/l in California. We request a breakout category for bituminous primers of at least 400-450 g/l.

Response: Please see response to Issue 1.

REFERENCES

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6. Clear Brushing Lacquer Coatings

Product Category Description:

Clear brushing lacquers are clear wood finishes, excluding clear lacquer sanding sealers, formulated with nitrocellulose or synthetic resins that dry by solvent evaporation without chemical reaction and provide a solid protective film which is intended for application by brush only. This is a new category that is currently included in the general lacquer category in district rules.

It is staff's estimate that clear brushing lacquers account for approximately five percent of the sales volume and three percent of the emissions from the general lacquer category. (ARB 1999; Deft, 1999)

Product Use and Marketing:

Clear brushing lacquers are sold in California to major home centers, paint stores, lumber yards, and hardware stores. The users range from the professional, the homeowner or do-it-yourselfer, to arts and crafts enthusiasts. Clear brushing lacquers are used to finish interior wood surfaces such as furniture, cabinets, paneling, and crafts. In the last decade, wood products are increasingly supplied by the manufacturer pre-finished eliminating the need to apply a finish at home or in the field. In California, a majority of new home or remodeling cabinetry is delivered pre-finished and field finished cabinetry occurs on a limited basis (e.g., custom fabrication).

Product Formulation:

The clear brushing lacquer category consists of solvent-based formulations and falls within the general lacquer category. Although the 1998 ARB Architectural Coatings Survey did not specifically survey this newly created category its sales were included under the surveyed subcategory “clear lacquers.” The VOC content of this category falls within the range of 650 g/l to 680 g/l. The formulations are clear coatings composed of synthetic thermoplastic film-forming materials in organic solvents (e.g.,ketones and esters) that dry by solvent evaporation. Most lacquers are based on nitrocellulose, the film forming material, dissolved in lacquer thinner, the solvent. Nitrocellulose is a cotton-like material derived from mixing the cellulose from trees with nitric acid. These solvent-based formulations have the unique quality of being able to be re-wetted or dissolved when more lacquer or lacquer thinner is applied over existing, dry lacquer. The ability to rewet or re-dissolve lacquer allows for easy repair and recoating without the need to sand between coats or completely remove the existing finish, with chemical solvent borne strippers.

Proposed VOC Limit and Basis for Recommendation:

The proposed 680 g/l VOC limit for clear brushing lacquers is technologically and commercially feasible by the January 1, 2003, effective date because this limit reflects the current VOC content for products in this category. ARB staff estimates that establishing a clear brushing lacquer category will result in a slight decrease in anticipated emission reductions from the general lacquer category, (moving from 550 g/l to 680 g/l). In creating this new category, staff

considered the unavailability of 550 g/l brushing lacquers and the transfer efficiency of sprayed lacquer versus a lacquer applied by brush only.

Based on ARB staff research and information provided by industry, staff is unaware of clear brushing lacquer formulations at 550 g/l capable of providing the necessary application and finish characteristics that are available with current 680 g/l clear brushing lacquers. The formulation changes for a 550 g/l spraying lacquer are not acceptable for brushing lacquers. Current 550 g/l lacquers are considered acceptable for spraying applications only. Achieving a 550 g/l brushing lacquer requires the use of strong solvents (e.g., acetone) that result in unacceptable performance with regard to application and finish. Lacquers are typically applied in multiple coats to achieve the desired finish. These 550 g/l formulations bite into previous coats, which results in an unacceptable brush drag and the brush becoming stuck in the previous coat due to solvents softening the prior coat when the second or third coat is applied. With spraying lacquers this is not an issue. Requiring a 550 g/l limit for clear brushing lacquers would essentially shift the current brush application of clear brushing lacquers to spray applied lacquers resulting in lower transfer efficiency. (Deft, 1999)

The transfer efficiency of lacquers applied by brush is essentially 100 percent compared with the typical 65 percent transfer efficiency of a sprayed lacquer. Therefore, applying one gallon of brushing lacquer at 680 g/l (100% transfer efficiency) is equivalent to applying 1.5 gallons of spraying lacquer at 550 g/l covering the same surface area. Thus, applying one gallon of brushing lacquer at 680 g/l results in or 5.7 pounds of VOC and applying 1.5 gallons of sprayed lacquer at 550 g/l that results in 7 pounds of VOC. Consequently, the brush application of a 680 g/l lacquer compared to a 550 g/l sprayed lacquer results in about a 20 percent decrease in emissions. Finally, spray lacquers require greater amounts of cleaning solvent than brushing lacquers, which would result in additional emissions compared to brushing lacquers. (Deft, 1999)

Staff also considered a reformulation approach for a 550 g/l sprayed lacquer. The approach we considered involved displacing traditional VOCs with exempt compounds (e.g., acetone) to determine the necessary volume needed for a 550 g/l sprayed lacquer to achieve the same emissions as a 680 g/l brushing lacquer. ARB staff estimates that 20 percent (by volume) of the traditional VOCs in a 550 g/l spraying lacquer would have to be replaced with exempt compounds to achieve equivalent emissions of a 680 g/l brushing lacquer. Based on ARB staff research and information provided by industry, reformulation of brushing lacquers using acetone, T-butyl or other exempt compounds has not yielded an acceptable product with the necessary application and finish properties.

ARB's proposal to create a clear brushing lacquer category is based on ARB staff analysis, technical information provided by industry and discussions with SCAQMD staff. As proposed, the clear brushing lacquer category would include a strict definition and labeling requirements prohibiting thinning. In addition, we are proposing a provision for annual reporting that would require the submission of annual volumes sold in California by manufacturers in order to monitor the category's usage patterns.

Issues:

1. Issue: This category was deemed unnecessary by the SCAQMD and was not included in Rule 1113. This proposed category represents another opportunity for industry to sell high VOC coatings, such as lacquers, by relabelling. Despite industry assurances that these coatings will only be brushed and not sprayed, enforcement at the point of sale will be impossible.

Response: The SCAQMD chose not to add a clear brushing lacquer category because it felt that the variance approach was more appropriate in order to encourage continued research on the part of the company requesting the variance. On April 20, 1999 the SCAQMD hearing board unanimously granted the company a variance for one year and expressed the opinion that a second year would be permitted if the company were unable to formulate a 550 g/l clear brushing lacquer. At the hearing , SCAQMD staff testified that there is no other compliant product in the market. The company has been researching 550 g/l brushing lacquer formulations for the past three years and under the variance it committed to continue diligent research towards compliance with a 550 g/l VOC limit.

Our proposal to create a clear brushing lacquer category is based on ARB staff analysis, technical information provided by industry and discussions with SCAQMD staff. As proposed, the clear brushing lacquer category would include a strict definition and labeling requirements prohibiting thinning. In addition, we are proposing a provision for annual reporting that would require the submission of annual volumes sold in California by manufacturers in order to monitor the category's usage patterns.

Enforcing the requirement that clear brushing lacquers will only be brushed and not sprayed is similar to current thinning prohibitions contained in existing coating rules. Brushing lacquers are too viscous to be sprayed, they require thinning to enable spray application. Thinning prohibitions can only be enforced via field inspections of coating operations and testing coating samples. Enforcing the “brush only” requirement will also require field enforcement. In addition, the labeling requirements will require the manufacturer to clearly identify on the primary label and application instructions that the product cannot be thinned or sprayed and must be applied by brush only.

REFERENCES

Air Resources Board, Final Report, “1998 Architectural Coatings Survey Results.” September, 1999. (ARB, 1999)

Deft, Inc. 17451 Von Karman Avenue, Irvine, CA 92614. Thomas P. Barnum, Vice President, Trade Sales, Lloyd Haanstra, Trade Lab Director. (Deft, 1999)

7. Faux Finishing Coatings

Product Category Description:

Faux finishes are coatings designed to create special effects such as dirt, old age, smoke damage, marble, or wood grain (Ralph Lauren, 9/98; Flood Company, 1996a). These coatings are generally clear glazes that are tinted or mixed with latex or solvent-based coatings to produce colored glazes (Ralph Lauren, 9/98; Behr, 2/99). Some coating additives or "conditioners" are also used in conjunction with solvent-based or latex coatings to make faux finishes (Flood Company, 1996b; Flood Company, 1997). Japan finishes, which are flat, quick-drying paste colors (T.J. Ronan, 1/4/00), may also be used as faux finishes after thinning (Universal Studios, 1/4/00). Faux finishes do not include general use flat and nonflat coatings, which may also be used in some faux finishing techniques. Sales and emissions information for faux finishes is not available since the ARB's Architectural Coatings Survey did not include a separate category for these products. However, we expect these coatings to represent a minor percentage of the overall sales from architectural coatings.

Product Use and Marketing:

Faux finishing products are sold in paint stores and artist supply stores. These products are used by the general public, graphic artists, motion picture and television studios, and businesses that specialize in decorating with faux finishes.

Faux finishes are generally applied over a household interior semi-gloss or satin/eggshell coatings (Sherwin Williams, 3/98; Golden Artist Colors, 1/4/00). The color of the background coating will combine with the colored glaze, which is the faux finish. A variety of techniques may be used in creating the desired artistic effects. These techniques include additive processes (sponging, ragging, washing) in which a natural sponge, newspaper, paper bags, plastic wrap, etc. are used to add the colored glaze over the base coat. Subtractive processes include sponging-off, ragging-off, and stippling. To perform these processes, an even coat of the glaze is applied over the base coat, and the glaze is then removed with a damp natural sponge, newspaper, plastic wrap, or a stipple brush. Marble, leather, or wood grain finish, may be achieved using various layers and colors of glazes. Tools typically needed for faux finishing techniques include brushes, feathers, paper bags, graining tools, and thin plastic wrap. (Ralph Lauren, 9/98; Sherwin Williams, 3/98)

Faux finishes are generally clear glazes that are designed to be tinted, or mixed with latex coatings (or solvent-based coatings in the case of solvent-based faux finishes) before application. The mixture's ratios will vary with the color and degree of opaqueness desired. In some cases, the products may be used "as-is" when a clear coating is desired. Japan finishes are different in that they are high-solids pastes that may be thinned down prior to use (Universal Studios, 1/4/00).

Product Formulation:

As mentioned above, faux finishes are generally clear glazes prior to tinting or blending with other coatings, and thus contain resins, solvents, and water (in latex products), but no

pigments. These products may have a higher concentration of slower evaporating solvents than typical household coatings in order to extend the "open" (wet) time. The longer "open" time allows the coating to be manipulated to create the desired artistic effects. After tinting or mixing with other coatings, the formulations will vary widely. Generally, when water-based faux finishes are mixed with household latex coatings, their VOC content would be expected to drop. Solvent-based faux finishes may be mixed with solvent-based coatings and mineral spirits (Sherwin-Williams, 1/99), which may increase or decrease the overall VOC content depending on the proportions used. Japan finishes are reportedly thick solvent-based alkyd coatings with a high concentration of pigments. These are reportedly thinned with solvent prior to use as faux finishes (Universal Studios, 1/4/00), which would increase their VOC content.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 350 g/l VOC limit for faux finishes, effective January 1, 2003. This VOC limit is technologically and commercially feasible as demonstrated by the complying water-based products currently on the market (Sherwin Williams, 3/98; Behr, 1/19/00). The U.S. EPA's national architectural coatings rule provides a 700 g/l VOC limit. However, we believe the proposed 350 g/l VOC limit is appropriate because we are aware of faux finishes currently on the market that are below this VOC level. The proposed VOC limit is also consistent with the SCAQMD's Architectural Coatings rule.

Manufacturers of noncomplying faux finishes have various reformulation options. Solvent-based products could switch to a water-based formulation or investigate the use of exempt VOC solvents. Water-based products will need to reduce the amount of solvents, or increase the amount of resin in the formulation. These changes may require manufacturers to investigate different solvents and resin systems, similar to the changes necessary for other general use flat and nonflat coatings. However, the 350 g/l VOC limit is substantially higher than the 100 and 150 g/l VOC limits proposed for general use flat and nonflat coatings, providing for a longer "open time" for these products.

Issues:

1. Issue: The ARB should create a 700 g/l VOC limit consistent with the U.S. EPA's national architectural coatings rule. To date, there has not been an identifiable way to reformulate these products to achieve a lower VOC content while maintaining the characteristics required for acceptable use, such as an extended open time.

Response: As stated above, we are aware of existing faux finishes that have a VOC content below the proposed 350 g/l VOC limit. One of these products has an open time of about 15 minutes (Sherwin Williams, 3/98), which is comparable to some higher VOC faux finishes (Sherwin Williams, 1/99; Golden Artist Colors, 1/4/00). We also note that a shorter open time can be accommodated by working in smaller sections.

2. Issue: It is unfair to calculate the VOC content of our water-based faux finishes on a less water basis. On a formula basis, the calculated VOC of our product can range up to 340 g/l. However, because the products are water-based, the VOC less water calculation results in a range of up to 700 g/l. Removing water to calculate the VOC content is unnecessary because achieving

these effects depends upon creating transparent layers. The addition of water to these coatings is required for optimum performance and does not result in the application of greater volumes of material to offset the resulting lack of opacity. Not only is there no benefit to imposing this restriction on water-based products, the requirement for removing water from the calculation will likely result in less use of water-based finishes and greater total VOC emissions.

Response: We are aware of water-based faux finishes that comply with the proposed 350 g/l VOC limit, *less water*, and are designed to create transparent layers. We expect that these products will result in less emissions than higher VOC water-based faux finishes.

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Universal Studios. Telephone conversation with ARB staff. January 4, 2000. (Universal Studios, 1/4/00)

8. Fire-Resistive Coatings

Product Category Description:

Fire-resistive coatings, also known as fireproofing materials or fire-resistant coatings, are used to bring building and construction materials into compliance with federal, State, and local building code requirements. These coatings must be tested and rated by an approved testing agency for their ability to protect the structural integrity of steel and other structural materials by increasing the fire endurance. The testing is done using time-temperature criteria of ASTM Designation E 119-98, "Standard Test Methods for Fire Tests of Building Construction Materials." This method is virtually identical to Universal Building Code (UBC) Method 7-1, as specified in the California Building Code. This category is proposed to be included in the SCM for the first time.

The National Architectural Coatings Rule combines fire-retardant and fire-resistant coatings into one category. We are proposing two separate categories because the coatings work in different ways, and the effectiveness of the coatings in protecting substrates against fire are measured by different methods. Fire-retardant coatings limit the spread of flame on the surface of interior building materials, while fire-resistive coatings protect the integrity of structural elements by limiting the penetration of flame.

The SCAQMD created a category for fireproofing coatings in its 1996 amendments to Rule 1113. This category was requested by industry to be separate from the fire-retardant coating category. The reasons the SCAQMD added this category were that the mode of action and the test methods differ for fire-retardant and fireproofing coatings. The definition for fireproofing coatings in the SCAQMD rule, however, did not include interior structural materials (SCAQMD, 1996). The ARB staff has independently concluded that two separate categories for fire-retardant and fire-resistive coatings are needed.

The 1998 ARB Architectural Coatings Survey did not include a category for fire-resistive coatings. Therefore, we have no estimate of sales or emissions. However, our investigation has shown that the fire-resistive coating category is very small and specialized. Based on the estimated 4,000 gallons of solvent-based product sold yearly in the South Coast Air Basin (SCAQMD, 1996), we estimate that statewide sales are less than 10,000 gallons per year.

Product Use and Marketing:

Fire-resistive coatings are specialty products applied by contractors. They are available from distributors or direct from the manufacturer. They are used in public buildings such as schools, hospitals, nursing homes, factories, high-rise office buildings, and sports complexes. Fire-resistive materials are tested with ASTM E 119, "Standard Test Methods for Fire Tests of Building Construction and Materials." The entire structure, such as a firewall, coated with the fire-resistive material is placed in a furnace and the time required to reach critical parameters is measured. For example, in firewalls, the time to reach "burn through" of the coating is measured. In structural steel coated with fire-resistive materials, the failure criterion is the internal temperature of the steel, based on the fact that the structural integrity of steel fails at 1200^{o} F. The fire rating is the time in hours required to reach the critical parameter of the

material being measured (Bratcher and Alvarez, 1996).

The California Building Code specifies fire resistive ratings for various types of construction with different occupancy levels, based on varying degrees of public safety. For example, Type I construction (structural elements of steel, iron, concrete, or masonry) must have 2-hour fire-resistive ratings for floors and roofs, while exterior bearing walls must have a 4-hour fire-resistive rating. Type V structures (homes) have 1-hour fire-resistive ratings for these same elements (California Building Code, 1998).

Professional architects and engineers use the Underwriters Laboratories (UL) Inc. Fire Resistance Directory to help them design buildings with the appropriate structural fire-resistive designs and materials. The structural element coated with the fire-resistive material is listed in the directory as "UL design numbers" for fire resistance, which gives the number of hours or the depth of penetration of the fire resistance. The thickness of the fire-resistive coating that must be applied to a given structural element, which will give a certain hourly rating, are derived from these UL fire resistance designs. There are design values for, as examples, floor assemblies, roof assemblies, and walls. Within these categories, the thickness of the fire-resistive material depends on, for example, steel size and shape, type of concrete, and thickness of concrete (Grace, undated). There are books of these design numbers available for the large variety of structural elements used in construction (Woods, 1999).

For example, the California State Fire Marshal lists fire-resistive designs such as structural members and walls/partitions. Some examples of fire-resistive materials include expansion joints and head-of-wall/wall-to-wall joint systems. Each of these materials is tested using ASTM Designation E 119 (UBC 7-1). Other materials such as acoustical materials and interior coating materials are tested for flame spread index with ASTM E 84 (State Fire Marshal, 1999).

Thus, the building codes determine the degree of fire resistance needed, and the test method that is used to evaluate the fire resistance of the coating. Registered architects or professional engineers must determine which hourly rating, UL design, and thickness of fire-resistive coating is needed for a building project, and these decisions must be reviewed and approved by the building code official (Grace, undated). However, manufacturers can choose to test their fire-resistive coatings at any of several testing laboratories approved by the California Fire Marshal and other building code officials. These coatings and the results of the testing data must be registered with the State Fire Marshal (Woods, 1999).

Product Formulation:

Fire-resistive coatings are generally of three types: gypsum-based cementitious coatings, fibrous (i.e., treated paper) coatings, and intumescent mastic coatings. The first two are solid materials, sprayed as a slurry, which insulates the structural element with exposed air pockets. Intumescent coatings form thick, puffy foam when exposed to high heat, which insulates the substrate against further intrusion of the flame.

Fire-resistive coatings are applied onto or impregnated into a substrate primarily for protective purposes, and they do not necessarily form a film. One commenter on the National

Rule requested clarification about the applicability of gypsum or cement-based, spray applied fire-retardant products that are applied to steel building surfaces during construction or renovation. The U.S. EPA confirmed that these cementitious fire protection products, that are often spray-applied as a thick slurry up to 3-1/2 inches thick and do not form a film as do other opaque fire-retardant materials, should be included in the fire retardant/resistive category (U.S. EPA, 1998b).

The thin film intumescent coatings have become more popular for structural steel with architects in recent years because of their appearance and design options that are not possible with the thicker films. Whereas with traditional material, where one to two inches of fire-resistive material might be required, only $1/16^{th}$ of an inch of the intumescent coating is needed to provide the same fire rating. The trade-off is that intumescent coatings cost more than traditional coatings (Bratcher and Alvarez, 1996).

Fire-resistive mastic coatings are usually solvent-based for exterior use and water-based for interior use. Fire-resistive coatings must be capable of withstanding abrasion, impact, freezing, and thawing, and must not form dust, flakes, cracks, or delaminate. They must withstand weathering, ultraviolet exposure, and vibration (Albi, undated). Water-based formulations are more challenging to formulate with the same hardness and exterior application properties under wet conditions (SCAQMD, 1996).

Some manufacturers recommend the use of a primer over steel, while others recommend that primer not be used, prior to the application of a fire-resistive coating. Some gypsum-based coatings can be used on the interior of structures, while others made with Portland cement can be used for exterior applications. Some coatings can be painted, but the painted surfaces must meet the surface flammability criteria of ASTM Method E 84. Sealers are usually not needed over these fire protection products (Grace, undated).

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit of 350 g/l is technologically and commercially feasible by the January 1, 2003, effective date based on: the technology assessment and limit in effect in the SCAQMD; and the fact that no variances from the 350 g/l limit have been requested from the 350 g/l limit in SCAQMD Rule 1113. The proposed limit reflects current technology. We do not expect that reformulation will be required at this time.

The National Rule VOC limit for clear fire-retardant/resistive coatings is 850 g/l. The category appears in other states' rules. The U.S. EPA does not provide a rationale for this VOC limit in the preamble to the National Rule or the Background Information Document (U.S. EPA, 1998a; U.S. EPA, 1998b).

During our technology assessment, some manufacturers requested a VOC limit for fire-resistive coatings of 420-430 g/l. Manufacturers claim that this limit is needed for exterior mastic coatings because they must withstand more rigorous weathering than interior coatings. In contrast, the interior mastic coatings are very low in VOC, but do not withstand the weathering criteria. However, these manufacturers have not provided test data, product literature, or VOC content data to support the need for a higher limit.

We recommend that the VOC limit for fire-resistive coatings be 350 g/l, the same as in the South Coast and Antelope Valley Districts. This limit has been successfully in effect since 1999 in the SCAQMD. We concur with the technology assessment of the SCAQMD in which the manufacturers who requested the category claimed that they could achieve the 350 g/l limit by January 1, 1999. To date, the SCAQMD has received no applications for variances from manufacturers of fireproofing coatings; therefore coatings sold in the SCAQMD with a VOC content higher than 350 g/l would be in violation of Rule 1113 (Berry, 2000).

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Woods, John, Deputy State Fire Marshal. Personal communication with ARB staff. October 21, 1999 and December 15, 1999. (Woods, 1999)

9. Floor Coatings

Product Category Description:

Floor coating is a generic term for a variety of high performance clear or opaque coatings used in areas with abrasion resulting from foot traffic or vehicular traffic. For purposes of this proposed SCM, floor coatings are defined only as opaque coatings. Due to their exposure to impacts and abrasion, floor coatings must also possess good adhesion qualities. These coatings are typically used in a variety of commercial and industrial applications, with some limited residential applications. (Note: varnishes that are recommended for use as floor coatings are subject only to the 350 g/l VOC content limit for varnishes.) (SCAQMD,1999)

The 1998 ARB survey shows that 1996 sales in California were 657,393 gallons for water-based formulations, or about 57 percent of the total floor coatings sales. The sales weighted average VOC content for water-based floor coatings is 164 g/l. The sales weighted average VOC content of the 493,568 gallons of solvent-based formulations was 197 g/l, which is greater than the proposed 100 g/l VOC limit (ARB, 1999).

Table D-9 below summarizes our estimate of sales and VOC emissions from the floor coatings category.

Table D-9
Floor Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	246	493,568	197	0.46
Water-Based	332	657,393	164	0.33
Total	578	1,150,961	157	0.79

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.

Product Use and Marketing:

Typical uses of floor coatings include a variety of commercial, industrial, and residential applications. These coatings are designed and recommended for application to either wood or concrete flooring including, but not limited to, residential and commercial garage floors, commercial parking garages, warehouse floors and residential and commercial wood floors, decks, porches, and steps. Many floor coatings are resistant to most solvents, some chemicals, as well as gasoline and oil spills. Floor coatings may also be formulated to have tire mark releasing properties when using an appropriate cleaner. Floor coatings are sold in hardware stores, department stores, at home improvement centers, and paint stores.

Appropriate surface preparation is essential to obtain adequate adhesion of floor coatings.

Typical recommended preparation is to remove all dirt, grease, oil, efflorescence, waxes and other foreign matter from the surface to be coated. On glossy surfaces, the surface should be deglossed to allow for better adhesion of the coating. When coating raw/bare smooth cured concrete, it is commonly recommended that the surface first be cleaned and lightly etched with an acid based solution. It may then be necessary to completely neutralize the substrate (above and below the surface) and let it dry. Etching a smooth concrete surface will increase the surface profile, resulting in better adhesion. Substrate alkalinity is also often a critical factor that may affect adhesion and overall performance of certain floor coating formulations. Therefore, it is often recommended that concrete be allowed to cure for at least 28 days prior to coating.

Product Formulation:

Typically, the coating system includes a primer and topcoat or a two-component single coat coating. Although formulated using a number of resin systems, the highest performing floor coatings are based on epoxy and polyurethane systems. Over the past five years, the most significant progress in floor coatings has been the development of zero-VOC, two-component, aliphatic polyurethane coatings, and two-component epoxy coatings. Regardless of the resin system employed, the use of a primer/sealer is often recommended to enhance adhesion. The newer polyurethane technology is based on both 1-part and 2-part coatings, with numerous products being offered as completely solvent-free systems. (SCAQMD, 1999)

There have been recent developments in water-based polyurethane coatings for high performance floor applications. Several paint manufacturers have commercialized two-component water-based polyurethane systems for heavy-duty concrete floor protection. These systems are virtually odor free, have 0 g/l VOC content, and provide excellent wear resistance. These formulations are based on water-dispersible aliphatic polyisocyanates and water-dispersible polyester polyols. (MPC, 1996)

Two component formulations may be subject to degradation from ultra violet (UV) exposure. For example, epoxies may chalk from UV exposure. The chalking does not effect the durability of the finish, only the appearance. There are, however, UV stabilized formulations available at an additional cost. Use of an additional topcoat is also an alternative to improve UV performance.

Proposed VOC Limit and Basis for Recommendation:

The proposed SCM recommends a VOC limit of 100 g/l for floor coatings. The proposed VOC limit is technologically and commercially feasible by the January 1, 2003, effective date based on our review of the literature and trade journals, complying market share, and information provided by manufacturers and resin suppliers.

Survey Results

Table D-10 below summarizes our estimates for this category of the number of products that were marketed in 1996 that complied with the proposed VOC limit, their associated market share for that year, and the emission reductions that would be realized if the limit were implemented in the non-SCAQMD portions of the State.

Table D-10
Floor Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
100	128	34.9	0.38

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
** Grams VOC per liter of coating, less water and exempt compounds.

Literature Search

As a part of the technology assessment, ARB staff gathered information on numerous floor coating systems that comply with the proposed limit.

For example, Air Products and Chemicals, a raw material supplier of architectural and high performance resins, is currently marketing the ADURA™ Polyols line, which is recommended for a variety of floor uses, including gymnasiums and industrial facilities. The two-component, aliphatic polyurethane formulations also provide excellent coverage. The lower-cost ADURA™ 50 is specifically recommended for concrete coating formulations. (SCAQMD, 1999)

The Sherwin-Williams Company markets a 100 percent solids, self-leveling epoxy coating called "ArmorSeal 650 SL/RC," which is a two-component, zero-VOC floor coating. They also have a zero-VOC primer recommended for use with the topcoat, as well as additional formulations of zero-VOC floor coatings. (SCAQMD, 1999)

Coatings Resources Corporation (CRC), a Southern California coating manufacturer since 1976, also manufactures several zero-VOC floor coatings. These include their CR-10, CR-11, CR-12, and CR-13 coatings, all 100 percent solids, epoxy or epoxy novolac formulations. In addition, CRC has single-component acrylic floor coatings with VOC contents of less than 50 g/l that are recommended for residential and commercial applications. (SCAQMD, 1999)

Madison Chemical Industries, Inc. has several high performance, zero-VOC, two-component coatings recommended for a variety of industrial and general maintenance uses, including flooring. Their Tufsheen II is a two-component aliphatic polyurethane coating that complies with the proposed limit for floor coatings. (MCI, 1999)

Hart Polymers, Inc., a supplier of raw materials and high performance coatings, also has a variety of water-based, zero-VOC, floor coatings. HP-100 is a two-component aliphatic urethane, offering excellent coverage and a pot life of 90 to 120 minutes. Hart Polymers also markets zero-VOC, single-component floor coatings in both aliphatic polyurethane and acrylic/aliphatic polyurethane dispersions, labeled HP-140 and HP-130, respectively. These single component floor coatings can also be used in residential environments. (SCAQMD, 1999)

Poly-Carb, Inc., a company based in Cleveland, Ohio, has a variety of high build, 100 percent solids, two-component floor coatings, with specialty formulations available for a

variety of chemical exposures. Specifically, the MARK-64.1 is a heavy duty floor coating recommended for wastewater and water treatment plant floors, industrial and manufacturing floors, laboratories, kitchens, food processing areas, high traffic areas, splash zones, and areas subject to corrosive acid and alkali spills. (SCAQMD, 1999)

Seal-Krete, Inc., a company based in Auburndale, Florida, markets several floor coatings that comply with the proposed VOC limit. Their zero-VOC product, Proformance Skid-Proof (PSP) is a water-based, acrylic-based, quartz, non-cementitious anti-skid coating. PSP is neutral in color and can be tinted by adding a desired color of exterior gloss acrylic, acrylic floor enamel or industrial acrylic enamel coating. When fully cured, it is hard and tough; yet flexible, with a high tensile strength, is waterproof, weather-resistant, impact resistant, salts resistant and chlorine resistant. PSP may be applied by trowel or spray hopper (a brush and roll down formulation is also available with 40 g/l VOC). During and after application before it has time to dry, PSP may be cleaned up with soap and water. PSP is used as a decorative, protective coating for long-term preservation of various surfaces including: concrete, wood, plywood, primed metal and styrofoam. PSP can be used on interior and exterior vertical and horizontal surfaces including traffic areas such as: walkways, patios, stairs, pool decks, balconies, ramps, and driveways. (Seal-Krete, 1999)

Vianova Resins, Inc., has developed floor coatings formulations (0 - 100 g/l VOC) based on their BECKOPOX epoxy resins and curing agents. These water-based coatings offer excellent adhesion, fast drying, high coverage rate, smooth flow and leveling and excellent lapping. (BECKOPOX, 1999)

Vianova Resins, Inc., has also developed their air-drying RESYDROL® AY466 high gloss enamel, an acrylic-modified, core-shell, alkyd emulsion formulation (72 g/l VOC). This high performance coating offers excellent application properties, superior scratch resistance, quick drying, and excellent weatherability, chemical resistance, and adhesion to wood. (Vianova Resins, 1999)

Other companies offering floor coatings that comply with the proposed 100 g/l limit include Polycoat Products, Ameron, United Coatings, Pacific Polymers, Tnemec, and Pittsburgh Paints. (SCAQMD, 1999)

Issues:

1. Issue: Two component coatings cost too much and are too difficult for the average homeowner to use.

Response: Many of today's two component coatings offer an extended pot life (up to 8 hrs) which greatly enhances their application. To assist homeowners, local hardware stores offer "How-To" clinics on many subjects. Sales representatives from one of the largest west coast retail hardware chains have indicated a positive response from homeowners regarding their use of two component floor coatings. In addition, although two component floor coatings will provide the highest performance, there are compliant single component coatings available with acceptable performance levels that are easier to use.

2. Issue: Two component coatings are too dangerous for the average homeowner to use.

Response: The moisture cured, two component, and prepolymer plus catalyst polyurethane coatings that contain free isocyanates can be hazardous and are only recommended for professional application.

There are other types of polyurethane coatings (oil modified, for example) that are available for the homeowner that have no free isocyanates. Two component epoxies do not have this type of hazard associated with their use. In addition, although two component floor coatings will provide the highest performance, there are compliant single component coatings available with acceptable performance levels.

REFERENCES

Air Resources Board. Final Report. "1998 Architectural Coatings Survey Results." September 1999. (ARB, 1999)

Madison Chemical Industries, Inc., Product Information. (MCI, 1999)

Modern Paint and Coatings, May 1996, pages 49-52, "Progress In Polyurethanes." (MPC, 1996)

Seal-Krete, Inc.'s World Wide Web Home Page, www.seal-krete.com. (Seal-Krete, 1999)

SCAQMD, Draft Staff Report, "Proposed Amendments to Rule 1113 – Architectural Coatings." May 14, 1999. (SCAQMD, 1999)

Vianova Resins, Technical Update, "Concrete Primers and Topcoats with BECKOPOX™ Epoxy Dispersions and Hardeners Exhibit Unique Application Properties and Excellent Performance." (BECKOPOX, 1999)

Vianova Resins, Inc.'s World Wide Web Home Page, www.vianova-resins.com. (Vianova Resins, 1999)

10. Flow Coatings

Product Category Description:

Flow coatings are products designed for use by electric power companies or their subcontractors to maintain the protective coating systems on utility transformer units. These coatings are extensively thinned with solvent to allow them to run down into electric utilities' transformer radiator fins to create a thin, even film that will not interfere with heat exchange. This method of application is necessary because it is difficult to apply paint in between the radiator fins by other painting methods (PG&E, 1/3/00a). According to one manufacturer, these coatings cannot be thinned down with water because they would dry too quickly in warm temperatures and would not flow out into a thin, even film (Triangle Coatings, 12/10/99).

We are proposing to add a new category for flow coatings in the SCM. These coatings are not regulated in district architectural coatings rules as a separate category (but instead are subject to the industrial maintenance category). However, as explained below, we believe that a new category and VOC limit for these products is justified. In addition, the U.S. EPA's national architectural coatings rule contains a separate category and VOC limit for these products.

No flow coatings were reported in the ARB's Architectural Coatings Survey. However, one manufacturer subsequently provided sales volumes in California, and VOC content information, indicating that these products contribute VOC emissions less than 0.01 tons per day statewide, excluding the SCAQMD.

Product Use and Marketing:

Flow coatings are highly specialized coatings used by electric power companies or their subcontractors, and are not available to the general public through typical retail outlets. As mentioned above, these coatings are designed to produce a thin film on transformer radiator fins that will not impede heat exchange. These coatings are applied with a hose over the top of transformer radiators, and allowed to run down the fins (Triangle Coatings, 12/10/99; PG&E, 1/3/00b). The excess coating drips into a collection basin at the bottom of the radiator, and a pump then pulls the excess coating from the basin where it is again applied over the top of the radiator fins until all of the radiator surfaces are coated. The excess coating in the basin can be recovered.

Product Formulation:

We are only aware of one flow coatings manufacturer that sells these products in California. This manufacturer currently produces a water-based flow coating developed specifically for PG&E, that is thinned extensively with butyl cellosolve to allow for the desired flow-out in warm weather conditions. Due to confidentiality concerns, we cannot reveal further details about this formulation.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 420 g/l VOC limit for flow coatings, effective January 1, 2003. This is slightly lower than the 450 g/l VOC limit in the U.S. EPA's national architectural coatings rule. However, the proposed VOC limit is technologically and commercially feasible because it essentially places a cap on the VOC content of existing products sold in California. We believe this proposed VOC level is appropriate because we are not aware of any lower VOC products or existing technology that would allow for compliance with a lower VOC limit. Increasing the solids level, or the amount of water, would not allow for the flow out needed in this application. These products would generally be subject to the 50 g/l VOC limit proposed for industrial maintenance coatings if they are not provided with a separate category. Finally, as mentioned above, the emissions from these products are less than 0.01 tons per day statewide, excluding the SCAQMD.

REFERENCES

Pacific Gas and Electricity (Mike Franklin). Telephone conversation with ARB staff. January 3, 2000. (PG&E, 1/3/00a)

Pacific Gas and Electricity (John Mayfield). Telephone conversation with ARB staff. January 3, 2000. (PG&E, 1/3/00b)

Triangle Coatings. Telephone conversation with ARB staff. December 10, ,1999. (Triangle Coatings, 12/10/99)

11. High-Temperature Coatings

Product Category Description:

High-temperature coatings are high performance products formulated, recommended, and designed for use on the surface of materials exposed continuously or intermittently to temperatures above 204°C (400°F). [This category differs from industrial maintenance coatings which are designed for repeated exposure to temperatures above 121°C (250°F)].

Table D-11 below summarizes our estimate of sales and VOC emissions from the high-temperature coatings category.

Table D-11
High-Temperature Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	91	22,839	367	0.05
Water-Based	113	175	222	~0.00
Total	204	23,014	366	0.05

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.

A high-temperature coating that also meets the definition of "metallic pigmented coating," containing at least 48 grams of elemental metallic pigment per liter (0.4 lb/gal) of coating as applied (see Section C-10), is subject only to the proposed 500 g/l VOC limit for "metallic pigmented coatings." A new category for "temperature-indicator safety coatings" (see Section A-26) is being proposed as a separate category from the "high temperature coatings" category. Section 3.2 of the proposed SCM has been revised to clarify that these categories are not subject to the most restrictive limit.

Product Use and Marketing:

Typical uses of high-temperature coatings include the protection of metal surfaces of furnaces, stacks, power plants, heat exchangers, boilers, exteriors of reactors, oil refineries, chemical plants, piping, exhaust mufflers, as well as other surfaces exposed to high temperatures.

Surface preparation and coating application methods should be similar to those for the more typical "industrial maintenance coatings" (see Section A-12). Manufacturer recommendations may include surface preparation by abrasive blasting or other methods, and application of the coating within a specified time period to avoid new rust. Application may be by spray equipment, especially for larger jobs. Some coatings may also be applied by brush or roller.

High-temperature coatings are sold by independent coating retailers and brand-name sales outlets that also sell the more typical "industrial maintenance coatings" (see Section A-12), however, there are fewer high-temperature coating products available and hence market availability is likely to be more limited.

Product Formulation:

Current high-temperature coatings are predominately solvent-based, constituting 99 percent of the sales volume reported in the 1998 ARB survey. High-temperature coatings may be formulated with resins containing silicon compounds, while containing less organic compounds that tend to deteriorate at higher temperatures. Traditional moderate temperature heat-resistant coatings include solvent-based silicone alkyd and silicone acrylic formulations, sometimes with zinc or aluminum pigments. Higher temperature heat-resistant coatings include solvent-based pure silicone formulations. Some heat resistant coatings require heat curing upon restarting (and thus reheating) the painted equipment. Newer heat-resistant coatings include a low-VOC (less than 250 g/l) siloxane formulation that is heat resistant up to 1112° F (600° C).

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit is 420 g/l, effective January 1, 2003. The proposed limit is technologically and commercially feasible, by the effective date, based on our review of complying market share, currently available coatings, the Harlan Associates Study, and the 420 g/l VOC limit currently in effect in eight district rules.

As indicated in Table D-12 below, 52 percent of the market already complies with the proposed limit. According to the ARB 1998 survey, a notable portion of the market consists of coatings with VOC content in the range from 450 to 500 g/l, which is slightly higher than the proposed VOC limit of 420 g/l. Coatings in this range may have the option to comply by adjusting their resins/formulations, tightening quality control, increasing solids content, or substitution of solvents with exempt compounds, such as Oxsol 100™ or the potential future exempt solvent tertiary-butyl acetate (TBAc™).

Table D-12
High Temperature Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
420	54	52	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

The proposed limit is already in effect in eight districts, with a ninth district (the SCAQMD) to have the limit in effect on July 1, 2006. In the eight districts the VOC limit will remain the same, resulting in essentially no reduction in the non-SCAQMD portion of the State with the proposed SCM limit. To allow time for the unique temperature-indicator safety coatings to comply with the 420 g/l limit, the South Coast AQMD has provided an interim limit of 550 g/l for the period from July 1, 2002, to July 1, 2006.

The following summarizes VOC limits in the U.S. EPA regulation for high-temperature

and related coatings.

VOC Limits Adopted by U.S. EPA

Coating Category	VOC Limit (g/l)*
High-Temperature	**650**
Heat-Reactive**	**420**

* Grams VOC per liter of coating, less water and exempt compounds.

** "Heat-reactive" coatings are phenolic-based coatings that require heat for curing (see Section B-9).

Harlan Associates Study

The Harlan Associates Study (Study) included testing of three high-temperature coatings with VOC contents below the 420 g/l limit, and two high-temperature coatings with VOC contents above the 420 g/l limit. The Study indicated that the performance of the high-VOC coatings and the low-VOC coatings was essentially equivalent for a number of critical areas. The tests included evaluations of coating heat resistance, stability, hardness, adhesion, dry-to-touch time, abrasion resistance, and impact resistance.

Issues:

1. Issue: The limit should initially be 550 g/l (as in SCAQMD rule), with the limit dropping to 420 g/l in the year 2006. For safety reasons, an oil refinery must use certain high-temperature indicator coatings, as required by current equipment designs. An initial limit of 550 g/l would allow current coatings to be used, while other products for high-temperature service are evaluated.

Response: A new category for "temperature-indicator safety coatings" is being proposed for this unique type of coating (see Section A-26). The limit for the new category is proposed to be 550 g/l, effective January 1, 2003. A limit of 420 g/l is proposed to be retained for other high-temperature coatings.

REFERENCE

Air Resources Board. Final Report. "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

12. Industrial Maintenance Coatings

Product Category Description:

Industrial maintenance coatings are high performance products designed for use to protect the surface of structures and other stationary equipment (except floors) exposed to one or more of the following extreme environmental conditions:

a. Immersion in water, wastewater, or chemical solutions (aqueous and non-aqueous solutions), or chronic exposure of interior surfaces to moisture condensation;
b. Acute or chronic exposure to corrosive, caustic or acidic agents, or to chemicals, chemical fumes, or chemical mixtures or solutions;
c. Repeated exposure to temperatures above 121°C (250°F). [However, if a coating is formulated, recommended, and used for applications to surfaces and materials exposed continuously or intermittently to temperatures above 204°C (400°F), the coating would fall into the category of "high-temperature coating" (see Section A-11)].
d. Repeated (frequent) heavy abrasion, including mechanical wear and repeated (frequent) scrubbing with industrial solvents, cleansers, or scouring agents; or
e. Exterior exposure of metal structures and structural components.

These coatings include primers, sealers, undercoaters, intermediate coats, and topcoats. Industrial floor coatings are not in the "industrial maintenance coatings" category, but are included in the "floor coatings" category with a VOC limit of 100 g/l.

A coating meeting the definition of "industrial maintenance coatings" may also meet the definition of "high temperature coatings," "metallic pigmented coatings" (e.g. anti-rust primers formulated with zinc dust), "pre-treatment wash primers," or "temperature-indicator safety coatings." Section 3.2 of the proposed SCM has been revised to clarify that these categories are not subject to the proposed limit for industrial maintenance coatings.

Some categories of coatings meet both the definition of "industrial maintenance coating" in the SCM and another coating category as defined in the U.S. EPA's national rule. In the national rule these "national categories" coatings are treated as separate categories with less stringent VOC content limits. In the SCM, only three of the "national categories" are treated as separate categories - "antenna coatings," "anti-fouling coatings," and "flow coatings." Section 3.2 of the proposed SCM clarifies that these categories are not subject to the proposed limit for industrial maintenance coatings. These categories are discussed in Sections A-3, 4, and 10.

The SCM does not consider the remaining "national categories" separately, so the VOC limit for "industrial maintenance coatings" would generally apply to these categories (as discussed in Section C of this Appendix).

In the SCAQMD rule, two other coating categories were separated from the industrial maintenance coating category (Rule 1113 - "Architectural Coatings," amended May 14, 1999). These categories are "chemical storage tank coating" and "essential public service coating." As

defined in the SCAQMD rule, a "chemical storage tank coating" (at 420 g/l, interim limit) is a coating used as an interior tank lining for the storage of oxygenated solvents, oxygenated solvent mixtures, or acid based products. As defined in the SCAQMD rule, "essential public service coating" (at 340 g/l, interim limit) is defined as a protective (functional) coating applied to components of power, municipal wastewater, water, bridges and other roadways; transmission or distribution systems during repair and maintenance procedures." Instead of the South Coast AQMD approach, the SCM would generally keep chemical storage tank and essential public service within the "industrial maintenance coating" category. However, to allow time for essential public service agencies to complete administrative processes before low VOC coatings can be used, the proposed compliance date is extended until January 1, 2004. This extension would avoid the need to provide essential public services a higher VOC limit until they receive approval to use complying coatings. Coatings for lining tanks and for aggressive exterior exposure are available with VOC contents below 250 g/l, including several with zero VOC.

Table D-13 below summarizes our estimate of sales and VOC emissions from the industrial maintenance coating category.

Table D-13
Industrial Maintenance Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	1,880	3,902,392	321	7.64
Water-Based	771	379,074	170	0.20
Total	2,759	4,281,466	300	7.84

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.

Product Use and Marketing:

Industrial maintenance coating is a generic term for a variety of high performance coatings used in areas with harsh environmental conditions. Typical users include onshore and offshore oil and gas production, refineries, petrochemical production and processing, marine, pulp and paper mills, bridges, manufacturing facilities, water supply facilities, and waste water treatment facilities. Coatings may be used for specific purposes. More specific examples include rust prevention for steel bridges exposed to coastal air and weathering, chemical protection of the interior of petroleum storage tanks and piping, corrosion prevention of the interior of tanks (such for potable water or sewage) at essential public services, protection of equipment at pharmaceutical manufacturing and food processing plants, and protection of industrial concrete surfaces (except floors). Some industrial maintenance coatings are intended for limited types of use while others are versatile and multifunctional. The coating may be recommended for heavy, moderate, or light industrial environments.

Industrial coatings are restricted to industrial users, as prescribed by the coatings

manufacturer. Marketing methods vary, in the way coatings get from the manufacturers to the end-users at industrial facilities. Independent coating retailers may provide specialized sales and services for industrial customers. The services may include field evaluations and consultation to determine appropriate coatings, available from a variety of manufacturers, and to facilitate proper coating selection and application. These independent retailers may sell certain coatings (non-industrial) to the public as well. Other independent retailers may sell primarily to the public consumer, and may provide industrial coatings on a limited basis or not at all. Some brand-name outlets market only its own proprietary line of coatings or predominantly its own line with supplemental coating products from other manufacturers. The brand-name companies may have large regional sales centers that provide consultation services and may sell their entire line of coatings for a multitude of purposes, including industrial maintenance. A manufacturer of industrial maintenance coatings, such as smaller companies with limited market distribution, may directly market and consult with industrial end-users. The industrial end-user may either have its own painting/maintenance staff or hire painting/maintenance contractors. [Note: Coatings in the "rust-preventative coatings" category are intended for residential use. Rust-preventative coatings may not be used for "extreme environmental condition" purposes in industrial facilities. (see Section A-21)]

Because of the variety of uses and types of coatings, the recommended surface preparation and application methods vary. For surface preparation in some situations, such as rust prevention of steel structures, abrasive blasting may be required to meet industry-standard surface condition specifications. Some abrasive blasting operations need containment equipment to reduce the spread of abrasives and debris beyond the immediate area. Concrete surfaces to be submerged may need abrasive blasting or etching with muriatic acid. In highly demanding environments, thorough surface preparation is crucial to the successful performance of the coating. In other situations, high-pressure water blasting, handtool cleaning, or wire brushing may be appropriate. Less demanding situations may require clean and dry surfaces with appropriate primers or base coats.

Application methods vary, from conventional air spray, airless spray, roller, spreader, squeegee, brush, or various combinations, depending on the coating and equipment to be coated. For larger jobs, spray application may be desirable because of faster application and less overall labor costs. Sometimes industrial-grade spray equipment and professional protective gear/clothing, including respirators, may be needed. Adequate ventilation must be provided, such as when working in the confined spaces of tank interiors. Two-part coatings (e.g. two-component polyurethane coatings and two-component epoxy coatings) require mixing, sometimes with power equipment, of the components shortly before application, providing a "pot life" usually within hours for surface application of the coating mix. Some coatings may be applied to entire pieces of equipment, while other coatings may be used during "touch up" of small areas. An industrial facility may need to take certain equipment, part of the facility, or the entire facility, out of operation (such as during scheduled maintenance periods) to apply the coating. Equipment intended for "immersion service" may need to be emptied and made safe for the workers. Because of the extreme conditions in some industrial environments, multi-coat systems (primer coat with midcoats/topcoats) may provide the best coating performance.

<u>Product Formulation</u>:

The industrial maintenance coating system may include a primer and topcoat or primer, midcoat, and topcoat, or "high-build" (thick, dry) coating. Coating formulations may be water-based or solvent-based. Among the high performance coatings are the alkyd, polyurethane, epoxy, acrylic, silicone, inorganic zinc, and vinyl formulations. Newer technology is based on both one-component and two-component coatings that achieve lower VOC content while maintaining or enhancing the protection characteristics of the coatings (South Coast AQMD, May 14, 1999).

Traditional industrial maintenance coatings include the solvent-based alkyd formulations, with VOC contents ranging from about 300 g/l to 420 g/l. Newer high-solids alkyd formulations are available with somewhat lower VOC content (up to about 340 g/l) than traditional alkyd formulations. Past efforts to market water thinnable alkyd formulations with lower VOC contents showed low market acceptance (Gordon and McNeill, 1992). However, the development of water reducible alkyd formulations is still a possible option for achieving lower VOC content levels in the future.

Among newer technologies, one of the most important is the development of aliphatic polyurethane formulations. These include water-based, zero-VOC, two-component formulations that are intended to meet or exceed the industrial high-performance level of traditional solvent-based coatings. Other polyurethane formulations are available with low VOC contents (up to 100 g/l), much lower than traditional coatings. Besides water-based polyurethane, solvent-based polyurethane formulations are also available, but with higher VOC contents (up to about 350 g/l). Two-component polyurethane coatings must be prepared by mixing-in a curing agent prior to application. Besides two-component formulations, moisture-cured polyurethane formulations are available that rely on absorption of moisture from ambient air for curing. Polyurethane coatings provide exterior durability, chemical resistance, and high gloss.

Another important technology is the development of epoxy formulations. These coatings include water-based formulations with zero or low-VOC content (up to 100 g/l), and solvent-based formulations with higher VOC content (up to about 350 g/l). These are generally two-component coatings prepared by mixing-in a hardener prior to application. Epoxy coatings are used for their chemical resistance, such as to alkalies, soaps, detergents, oils, and solvents, as well as their resistance to hot and cold water, and for their adhesion to surfaces and materials. Because of these characteristics, epoxy coatings are often used as primers, linings for tanks and piping, and concrete surfacing. "High-build" epoxy coatings are available for lining tanks to protect them during immersion service. In some situations, epoxy coatings are not preferred for use as exterior topcoats, because they may chalk after exterior exposure (Gordon and McNeill, 1992).

Acrylic coating technology, in water-based and solvent-based formulations, is used for industrial maintenance because of the exterior durability and chemical inertness of the coatings. Many water-based acrylic formulations are available with low VOC contents. An acrylic coating may be recommended as a primer, topcoat, or as a single coat (sometimes referred to as "direct to metal" for steel). Some acrylic coatings, such as for single coat use, are recommended for light to moderate industrial environments. Certain acrylic coatings are suitable for use in food processing facilities regulated by the U. S. Department of Agriculture. Vinyl technology provides coatings with water, abrasion, and chemical resistance characteristics (Gordon and

McNeill, 1992).

Zero and low VOC coatings may be formulated with novolac (phenol formaldehyde resin) technology or with siloxane technology. Siloxane is a class of silicon containing compounds. Siloxane technology may be used for providing greater heat-resistance characteristics to the coating.

There are modern coating systems available with zero-VOC content that combine a water-based epoxy primer and a water-based polyurethane topcoat. In this coating system, the best characteristics of epoxy and polyurethane coatings are used in a combination that is superior to either type of coating alone. Similar epoxy primer/polyurethane topcoat systems are available with low VOC contents. There are coating systems that combine an epoxy primer with an acrylic topcoat.

Coal tar epoxy coatings are used to protect steel and concrete in underground and immersion service and for protection against attack by acids, alkalies, petroleum, petrochemicals, sewage, and other chemicals. Some of these coatings are high solids formulations with low VOC content (up to about 250 g/l).

Zinc primers, containing zinc dust, are used for corrosion protection of iron and steel surfaces and structures in industrial situations. A coating meeting the "metallic pigmented coating" definition would be subject to the proposed 500 g/l VOC limit for that category (see Section C-10)]. However, if a primer contains less than this level of metallic pigment, the coating would typically fall into the "industrial maintenance" category. The function of zinc primers is to provide cathodic protection for underlying iron or steel, in situations where repainting is much more cost-effective than replacement of the iron or steel. Resins may be organic or inorganic (Gordon and McNeill, 1992). Inorganic zinc primers are available with zero and low VOC contents.

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit is 250 g/l, effective January 1, 2004. The proposed limit is technologically and commercially feasible, by the effective date, based on our review of complying market share, currently available coatings, the Harlan Associates Study, the National Technical Systems (NTS) study, trade journals, and information from coatings and resin manufacturers.

The 1998 ARB survey shows that 28 percent of the market and 941 of the coating products already meet the proposed limit (Table D-14). We estimate that emission reductions in the non-SCAQMD portion of the State will be 3 TPD from a 250 g/l limit.

Table D-14
Industrial Maintenance Coatings*

Proposed VOC Limit (g/l)**	No. of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
250	941	28	2.98

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

** Grams VOC per liter of coating, less water and exempt compounds.

There are numerous coating formulations on the market, with zero or low-VOC contents that would comply with the proposed 250 g/l limit. Some are within the zero to 100 g/l range (South Coast AQMD, May 14, 1999; ARB list of coatings in Tables D-11 and D-12). Many of these are water-based polyurethane, epoxy, or acrylic formulations. There are solvent-based polyurethane, epoxy, and acrylic formulations with higher VOC contents in the 250-350 g/l range. We believe these coating formulations may be modified to comply with the proposed limit. For example, the resin may be modified to allow the solids content to be increased to displace some of the solvent. Current formulations with VOC contents above 350 g/l may need more extensive reformulation, such as solvent substitution with exempt compounds (e.g. Oxsol 100™ or the potential future exempt solvent tertiary-butlyl acetate (TBAc™)). For solvent-based two-component polyurethane formulations, it may be possible to lower the VOC content with new polyurethane prepolymers that need less solvent, and reformulating with reactive diluents (Dassner and Johnson, 1996). Reactive diluents initially act as solvents and then form part of the coating, instead of evaporating away, thus reducing VOC emissions.

The solvent-based alkyd formulations may contain VOCs in the range of 300 to 420 g/l. One possible compliance option for these coatings would be substitution of traditional organic solvents with low-reactivity exempt solvents. Oxsol 100™ is one exempt solvent currently available. A potential future exempt solvent is tertiary-butlyl acetate (TBAc™), believed to be a potential replacement for a variety of traditional organic solvents, such as toluene, xylene, methyl ethyl ketone (MEK), and methyl isobutyl ketone (MIBK) (Pourreau et. al., 1999). Two other options being considered are high-solids alkyd formulations and water reducible alkyds. Other options, going beyond pure alkyd formulations, involve the development of alkyd hybrids to achieve lower VOC levels while possibly enhancing other performance characteristics. Possible hybrids include rosin and phenolic-modified alkyds, acrylic alkyd copolymers, silicone alkyds, and epoxy ester modifications (Ryer, 1998).

The most common current district VOC limit is 420 g/l, although several districts have a VOC limit of 340 g/l. In the SCAQMD, the interim VOC limit is 250 g/l, effective July 1, 2002, and the final VOC limit is 100 g/l, effective July 1, 2006 (except for essential public service coatings and chemical storage tank coatings with different interim limits, as previously discussed).

The following summarizes VOC limits in the U.S. EPA regulation for industrial maintenance and related coatings.

VOC Limits Adopted by U.S. EPA

Coating Category	VOC Limit (g/l)*
Industrial Maintenance	450
Antenna	530
Anti-Fouling	450
Anti-Graffiti	600
Chalkboard Resurfacers	450
Extreme High Durability	800
Flow	650
Heat Reactive	420
Impact Immersion	780
Nonferrous Ornamental Metal Lacquers and Surface Protectants	870
Nuclear	450
Repair and Maintenance Thermoplastic	650
Thermoplastic Rubber and Mastics	550

* Grams VOC per liter of coating, less water and exempt compounds.

Harlan Associates Study

The Harlan Associates Study tested the performance of 13 industrial maintenance primers (5 below 250 g/l, and 8 above), and 12 industrial maintenance topcoats (5 below 250 g/l, and 7 above). For the primers, the performance characteristics tested include stability, hardness, application, adhesion, drying time, impact resistance, flexibility, and salt spray. For the topcoats, the performance characteristics tested included the same tests and added tests for accelerated weathering and gloss.

In general, the performance of low-VOC coatings was similar to high-VOC coatings, however, some differences were noted. For the primers, the low-VOC primers showed better results from the tests for adhesion, flexibility, and impact resistance, while the high-VOC primers showed better results from the tests for salt spray, and water immersion. For the topcoats, the low-VOC topcoats showed better results from the tests for flexibility, while the high-VOC topcoats showed better results from the tests for appearance, salt spray, and gloss.

NTS Study

The National Technical Systems study tested the performance of industrial maintenance coatings individually as primer coats and topcoats, and together as coating systems (primer coats with appropriate topcoats). More than half of the 47 coatings tested were two-component coatings.

The study showed the performance of low-VOC coating systems was essentially similar to high-VOC coating systems except during one test. The low-VOC coating systems showed better mar resistance than the high-VOC coating systems. The study also showed that the performance of low-VOC primer coats and topcoats (tested separately) was essentially similar to that of high-VOC coatings.

Issues:

1. Issue: A limit of 250 g/l is not stringent enough, and an effective date of July 1, 2002, (previously proposed) is too late. Ultra-low VOC coatings and the raw materials to make them are already available. Currently available ultra-low VOC coatings outperform existing solvent-based coatings. The SCAQMD has identified 55 commercially available high-performance industrial maintenance coatings at 100 g/l or lower for essentially any use and application. The ARB should lower the VOC limit to 100 g/l, to be effective January 1, 2001.

Response: The industrial maintenance coatings category covers a very broad range of coating uses and coating formulations. The proposed VOC limit of 250 g/l and the proposed effective date (revised to January 1, 2004) would provide more opportunity for a broader variety of coating formulations to be available in the future to meet those varied needs. For example, the current alkyd formulations are solvent-based with VOC contents of about 400 g/l. We are aware of efforts to develop low-VOC alkyd formulations, including water-reducible alkyds. We believe that the proposal would allow resin and coating manufacturers to continue to develop different types of low-VOC coatings. This would ultimately provide more flexibility to industrial end-users to address specific coating needs.

2. Issue: The "industrial maintenance" category is too broad and does not consider special uses. Subcategories should be created and provided with less stringent limits when justified. Various commenters suggested the following subcategories.

"Essential public services" (as in SCAQMD rule)
Combining similar private facilities with "essential public services"
"Chemical storage tank" (as in SCAQMD rule)
Tank lining and piping
Immersion service - water, wastewater, petrochemicals, other chemicals (general)
Bridges and similar structures, storage tanks
Zinc-rich coatings
Include "new construction" in the definition of "industrial maintenance coatings"
Include "commercial" and "institutional" use in definition of "industrial maintenance coatings"

More stringent limits and low-VOC technologies should be directed toward uses in which the technologies are most feasible. Less stringent limits should be provided for uses in which low-VOC technologies are less feasible.

Response: In general, dividing the "industrial maintenance" category into subcategories would make the SCM provisions more difficult for districts to enforce and create more confusion to the regulated community. As discussed above, there are several reformulation options available to meet the proposed limit. To provide time for essential public service agencies to complete administrative processes before low VOC coatings can be used, the ARB staff is proposing to delay the effective date of the 250 g/l limit until January 1, 2004. This extension would avoid the need to provide essential public services a higher VOC limit until they receive approval to use complying coatings.

3. **Issue:** Government agencies may specify or may need to approve coatings for certain types of use. There is a problem when no low VOC coating is specified/approved, because several years of field testing and evaluation by another organization may be needed before a low VOC coating can be used in some situations.

Response: The ARB staff is proposing to delay the effective date of the 250 g/l limit until January 1, 2004. This would provide time for essential public service agencies to complete administrative processes, required before low VOC coatings can be used. This extension would avoid the need to provide essential public services a higher VOC limit until they receive approval to use complying coatings. As discussed above, there are several complying solvent-based and water-based coatings reformulation options available. Existing coatings meeting the proposed 250 g/l limit are available now.

4. **Issue:** For immersion service, there are no accelerated test methods available. Many years of field testing are needed to demonstrate the suitability of a new coating for immersion service.

While in service, the coating may be submerged for years and may not be easily inspected visually. High-volume, turbulent liquid flow rates inside piping may substantially accelerate any coating failure and the subsequent equipment failure, if a defect starts in the coating. The coating must be highly reliable. The liability of coating failure is very high.

Essential public services, such as agencies that supply fresh water or treat wastewater, recommend a limit in the 340 to 350 g/l range to allow time for laboratory, field testing, and approval of low-VOC coatings. To address concerns, SCAQMD has provided an interim district limit of 340 g/l for "essential public service coatings."

Response: See responses to issues 2 and 3.

5. **Issue:** Most bridges and similar structures have isolated areas that need higher-VOC coatings. Also, bridges exposed to the severe conditions along the California coast need higher-VOC coatings. These coatings have no suitable replacement. To address these concerns, the SCAQMD has provided an interim district limit of 340 g/l for "essential public service coatings."

Response: See responses to issues 2 and 3.

6. **Issue:** Development time for chemical tank coatings is very long. It is not possible to predict the types of aggressive chemicals that will need storage. For example, the composition of gasoline changes with respect to additives. To address these concerns, the SCAQMD has provided an interim district limit of 420 g/l for "chemical storage tank coatings" used for the interior of tanks storing oxygenated solvents, oxygenated solvent mixtures, or acid-based products.

Response: See responses to issues 2 and 3.

7. **Issue:** Some structures that were originally coated with solvent-based coatings need

patch repair and maintenance with compatible coatings. A coating manufacturer or government agency may require specific high-VOC coatings for this purpose.

Response: See responses to issues 2 and 3. The time extension would apply to all uses, including patch and repair.

8. Issue: Consideration should be given to atmospheric conditions more extreme than in the SCAQMD during application of coatings. Other areas of California have higher temperatures, lower temperatures, and higher humidity. To accommodate these conditions, higher VOC coatings are needed. A limit of 340 g/l may be appropriate.

Response: See responses to issues 2 and 3.

9. Issue: A limit of 250 g/l is not proven for tank lining exposure or for aggressive exterior exposure involving ultra-violet light together with moisture, salt, chemical fumes, temperature extremes.

Response: See responses to issues 2 and 3. Coatings for lining tanks and for aggressive exterior exposure are available with VOC contents below 250 g/l, including several with zero VOC.

10. Issue: A limit of 250 g/l would prohibit the use of more than 95 percent of the coatings now used for oil refinery tanks. Similar problems exist with coatings for refinery vessels, exchangers, furnaces, and piping.

Response: See responses to issues 2 and 3.

11. Issue: A limit of 250 g/l is feasible with one important exception - coatings for tanks and piping.

Response: See responses to issues 2 and 3.

12. Issue: The VOC limit should initially be 420 g/l, lowered to 340g/l after several years, and then lowered further to 250 g/l after several more years.

Response: See responses to issues 2 and 3.

13. Issue: To meet a limit of 250 g/l by 2002 (previously proposed effective date), regulatory flexibility should be provided for low volume, noncompliant, special-use coatings. Examples of regulatory provisions for flexibility include averaging, variance procedure, and/or small volume exemption.

Response: As discussed above, the ARB is proposing to include three of the small "national" categories in the SCM. These new categories include special-use small volume coatings for which it is not technologically and commercially feasible to meet the proposed 250 g/l limit. To provide compliance flexibility, the ARB staff is considering development of an optional averaging provision for coatings manufacturers.

14. **Issue:** The ARB should withhold adoption of any SCM limit until results from the NTS study are reviewed by ARB and industry. The performance of reformulated industrial maintenance coatings is a major concern to painting contractors.

Response: As discussed above, the NTS study shows the performance of zero and low-VOC industrial maintenance coatings is similar to the performance of traditional high-VOC coatings. Results showed the mar resistance of low-VOC coating systems was better than high-VOC coating systems. The ARB staff is proposing to delay the effective date of the 250 g/l limit until January 1, 2004.

15. **Issue:** It is not possible to make industrial maintenance coatings of the quality, flexibility of application, and chemical safety expected by customers at the proposed VOC limit.

Response: See responses to issues 2 and 3. In addition, zero and low-VOC formulations result in lower VOC emissions and thus provide the safety benefits of lower solvent levels in the air.

16. **Issue:** There should be language uniformity with the national rule to minimize the marketing of two types of industrial maintenance coatings, one to California customers and another to the rest of the nation. Also, different definitions and different limits would prevent California customers from obtaining the best products.

Response: The national rule is intended to be minimum national requirements. Because California has the most severe ozone air quality problem in the nation, California needs to adopt lower VOC limits that are technologically and commercially feasible.

17. **Issue:** Water-based industrial maintenance primers will not adhere to concrete treated with form release compounds. Galvanized metal and aluminum and concrete treated with silicone, silane, or siloxanes do not allow water-based primers to stick. Solvent-based primers at 350 g/l are needed.

Response: See responses to issues 2 and 3. Proper surface preparation of the substrate is crucial to the performance of any coating, and especially so in the case of high-performance industrial maintenance coatings.

18. **Issue:** The definition of "industrial maintenance coating" should include coatings for electric transformers on a pole and underground vaults.

Response: The definition of "industrial maintenance coating" is sufficiently broad to include coatings for electric transformers on a pole and underground vaults. More specifically, section 2.25.1 refers to "…chronic exposure of interior surfaces to moisture condensation…", section 2.25.2 refers to "…chronic exposure to corrosive, caustic, or acidic agents…"; and section 2.25.5 refers to "… exterior exposure of metal structures and structural components…"

19. **Issue:** There is confusion concerning the use of "industrial maintenance coatings" and the use of "rust preventative coatings" because of category overlap, inconsistencies of the

definitions, labeling requirements, and other inconsistent provisions.

Response: The ARB staff has revised the proposal to address these comments. The staff has deleted the provision that would have allowed "rust preventative coatings" that also meet the definition for "industrial maintenance coatings" to be subject only to the less stringent 400 g/l limit for "rust preventative coatings." Also, "rust preventative coatings" are for residential use only and only on metal substrates.

20. Issue: There is a potential for manufacturers of industrial maintenance coatings to relabel higher VOC coatings into the "rust preventative coatings" category, to take advantage of a less stringent limit of 400 g/l. This could result in less emission reductions achieved in the "industrial maintenance coatings" category. The "rust preventative coatings" category is intended for residential users.

Response: The staff has deleted the provision that would have allowed "rust preventative coatings" that also meet the definition for "industrial maintenance coatings" to be subject only to the less stringent 400 g/l limit for "rust preventative coatings." This revision should more effectively separate the use of coatings in these two categories. ARB staff will monitor the sales of "rust preventative coatings" by evaluating data obtained from coatings manufactures, to be submitted in accordance with Section 5.2 of the SCM.

21. Issue: Anti-graffiti coatings are within the "industrial maintenance coatings" category. Since only industrial users may use coatings in this category, this creates a problem for residential, commercial, and institutional users of anti-graffiti coatings, who are not clearly industrial users. Certain high-performance coating characteristics are needed in anti-graffiti coatings, and hence they are similar to some types of industrial maintenance coatings.

Response: In addition to industrial use, the SCM allows the commercial and institutional use of anti-graffiti coatings that are classified as industrial maintenance coatings, for areas with extreme environmental conditions including surfaces subject to graffiti abuse/subsequent cleaning. For residential use (and for commercial, institutional, and industrial use as well), our review of anti-graffiti coatings (see Section B-1) shows there are numerous available coatings, including the permanent-type and the sacrificial-type, that can meet the proposed VOC limit of 100 g/l for flat coatings and the proposed VOC limit of 150 g/l for non-flat coatings. Permanent-type anti-graffiti coatings designed to resist repeated scrubbing with harsh solvents may be formulated and marketed by coatings manufacturers to be classified as either an industrial maintenance coating or as a flat/non-flat coating for general use, including residential use.

REFERENCES

Air Resources Board, Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

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Gordon, J.A. and McNeill, R.A. (1992) *A Condensed Comprehensive Course in Coating Technology - Syllabus*. (Gordon and McNeill, 1992)

Pourreau, D.B., Kelly, G.B., Junker, L.J., Wojcik, R. T., Goldstein, S.L., and Morgan, M.J. "Formulating VOC-Compliant Coatings with Exempt Solvents - A Case Study on Tertiary-Butyl Acetate (TBAc™)", *Paint & Coatings Industry*, pp 84-100, November 1999 (Pourreau et. al., 1999)

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SCAQMD Staff Report. *Amend Rule 1113 - Architectural Coatings*. May 14, 1999 Board Meeting (SCAQMD, May 14, 1999)

13. Lacquer Coatings

Product Category Description:

Lacquers are clear or opaque wood coating products, including clear lacquer sanding sealers, formulated with cellulosic or synthetic resins to dry by evaporation without chemical reaction and to provide a solid, protective film. Lacquer sanding sealers are included in the category description and definition because they function like lacquers. Nitrocellulose and cellulose acetate butyrate are the most common film forming ingredients found in traditional lacquers.

Table D-15 below summarizes our estimate of sales and VOC emissions from the lacquer coating category.

Table D-15
Lacquer Coatings*

	Number of Products	Category Sales (gallons/ year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	340	625,938	647	2.48
Water-Based	63	43,679	181	0.02
Total / Overall	403	669,617	617	2.50

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

Product Use and Marketing:

Lacquers are sold in California to major home centers, paint stores, lumber yards and hardware stores. The users range from the professional contractor to the homeowner or do-it-yourselfer. The many uses for lacquer include wood finishing for, but are not limited to, wood paneling, floors, doors, windows, furniture, and cabinets. In the last decade, wood products are increasingly supplied by the manufacturer pre-finished, eliminating the need to apply a finish at home or in the field. In California, a majority of new home or remodeling cabinetry is delivered pre-finished and field finished cabinetry occurs on a limited basis (e.g., custom fabrication).

Product Formulation:

The lacquer category is dominated by solvent-based formulations. Based on the 1998 ARB Architectural Coatings Survey solvent-based formulations accounted for 94 percent of the total sales volume with water-based formulations comprising the remaining six percent. In the 1998 ARB Architectural Coatings Survey this category is further broken down into clear and opaque lacquer categories. Clear lacquer formulations accounted for 69 percent of the total sales volume with opaque formulations accounting for the remaining 31 percent.

The VOC contents of traditional solvent-based lacquers are in the 650 g/l to 680 g/l range. The 1998 ARB Architectural Coatings Survey reports a VOC content range of 600 g/l to 680 g/l for solvent-based products, with a sales weighted average of 647 g/l. The formulations are clear coatings composed of synthetic thermoplastic film-forming materials in organic solvents (e.g., lacquer thinner or mineral spirit) that dry by solvent evaporation. Most lacquers are based on nitrocellulose, the film forming material, dissolved in lacquer thinner, the solvent. Nitrocellulose is a cotton-like material derived from mixing the cellulose from trees with nitric acid. These solvent-based formulations have the unique quality of being able to be re-wetted or dissolved when more lacquer or lacquer thinner is applied over existing, dry lacquer. The ability to rewet or re-dissolve lacquer allows for easy repair and recoating without the need to completely remove the existing finish.

For the water-based formulations, the 1998 ARB Architectural Coatings Survey reports a VOC content range of 160 g/l to 220 g/l with a sales weighted average of 181 g/l. Water-based formulations are similar to solvent-based formulations in creating a thermoplastic film, but with the use of vinyl, acrylic, polyurethane or urethane/acrylic latex blend type resins that are not resoluble in their original solvent.

Proposed VOC Limit and Basis for Recommendation:

The proposed 550 g/l limit for lacquers is technologically and commercially feasible by January 1, 2003, based on information from coating manufacturers and complying market share. The use of acetone as an alternative VOC exempt solvent has resulted in achieving 550 g/l VOC contents without sacrificing significant properties preferred by the wood finishing industry. Major manufacturers have introduced nitrocellulose lacquers using acetone to lower the VOC content to 550 g/l. Other alternative solvents for lacquer may include t-butyl-acetate (VOC exemption pending) and Oxsol 100 (parachlorobenzotrifluoride - VOC exempt).

The SCAQMD Rule 1136 “Wood Products Coatings” was amended in June 1996 to include a 550 g/l VOC limit for these coatings. At that time, the coating formulators supported the SCAQMD 550 g/l limit for lacquers. Surface Protection, Inc., Guardsman, Akzo-Nobel, Sherwin Williams, and AMT have all introduced acetone-based formulations of nitrocellulose lacquers, which have been used successfully by manufacturers of wood furniture, kitchen and bath cabinets, and shutters. (SCAQMD, 1996)

Alternative formulations of lacquers have seen significant development in recent years. The water-based formulations reported in the 1998 ARB Architectural Coatings Survey also provide formulators an avenue of compliance. The proposed VOC limit provides manufacturers the flexibility to continue the use of traditional lacquers or take advantage of existing water-based formulations. The emission reductions below have been adjusted to exclude the Clear Brushing Lacquer category.

Table D-16 below summarizes our estimate of complying products, market share, and emission reductions outside the SCAQMD.

Table D-16
Lacquer Coatings*

Proposed VOC Limit (g/l)	No. of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons per day)
550	138	13.8	1.04

* Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Issues:

1. Issue: The use of acetone could result in flammability problems.

Response: Many of the solvents used in solvent-based lacquers or other coatings are also flammable and must be handled with care. Acetone's flashpoint temperature, flammability classification and lower explosive limit are similar to other solvents (e.g., MEK, toluene, xylene) found in solvent-based coatings. Flammability classifications by the Fire Department are the same for acetone, MEK, toluene, and xylene. Using operating guidelines for working with flammable coatings under well-ventilated areas, as prescribed by fire department codes, will avoid the concentration of acetone vapors required to cause an explosion. (SCAQMD, 1996)

REFERENCES

Air Resources Board, Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

Air Resources Board, Technical Support Document, "ARB-CAPCOA SCM for Architectural Coatings." July, 1989. (ARB, 1989)

SCAQMD, Draft Staff Report, "Proposed Amendments to Rule 1113 – Architectural Coatings." September 26, 1996. (SCAQMD, 1996)

United States Environmental Protection Agency, "Final Rule: National Volatile Organic Compound Emission Standards for Architectural Coatings," 40 CFR part 59, subpart D, 63 FR 48848, September 11, 1998. (U.S. EPA, 1998)

14. Low Solids Coatings

Product Category Description:

Low solids coatings are products formulated to contain one pound (0.12 kilogram) of solids or less per gallon of coating. The VOC content of the low solids coating is calculated as the actual VOC of the material, that is, without subtracting out the water and exempt compounds. This category was not included in the 1989 SCM, although it is in some more recently amended district rules. The only low solids coatings reported in the 1998 ARB survey are low solids stains and low solids wood preservatives.

The National Rule has separate categories for low solids stains and low solids wood preservatives, both with VOC limits of 120 g/l. The U.S. EPA's rationale was that a low solids category was needed because at a very low solids content, coating coverage is controlled by volume, not the solids content. In other low solids applications, such as lacquers for metal, the solids content, rather than the volume, determines the amount of coating used; that is, more gallons of a low solids coating would be needed for the same coverage as a higher-solids coating. Thus, the U.S. EPA restricted the low solids category to stains and wood preservatives because it had no data or other information about any other low solids categories (U.S. EPA, 1998).

Tables D-17a and D-17b below summarize our estimate of sales and VOC emissions from the low solids coating category.

Table D-17a
Low Solids Stains*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD (tons/day)
Solvent-Based	0	0	N/A	0.00
Water-Based	PD	PD	77	0.01
Total	PD	PD	77	0.01

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

PD = Protected Data.

Table D-17b
Low Solids Wood Preservatives*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD (tons/day)
Solvent-Based	0	0	N/A	0.00
Water-Based	PD	PD	42	0.00
Total	PD	PD	42	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.
PD = Protected Data.

It should be noted that the definition used in the ARB's 1998 Architectural Coatings Survey was that of the draft National Rule, which included a 50 percent water requirement.

Product Use and Marketing:

Low solids coatings are sold in hardware stores and home centers. The products are used for the same purposes as regular stains and wood preservatives, for example protection of exterior wood surfaces.

Product Formulation:

Low solids stains and wood preservatives are formulated to contain less than one pound of solids per gallon of coating. This category includes high-water, low-solids coatings that could meet the 120 g/l VOC limit by formulating with water or exempt solvents.

The calculation of VOC on a material basis is an important criterion in this category. For example, in a typical low solids product, on a less water and exempt solvents basis, the labeled VOC would be 470 g/l, but only 80 g/l on a material basis. Because the low solids products are mostly water, we believe this calculation is a reasonable approach for determining the VOC content.

Proposed VOC Limit and Basis for Recommendation:

The proposed 120 g/l VOC limit is technologically and commercially feasible by the January 1, 2003, effective date based on: complying market share; the limit in current district rules and the National Rule; and discussions with manufacturers and other interested parties.

We recommend that the low solids stains and low solids wood preservatives be combined into one low solids category because both subcategories have the same VOC limit. This is a cap on current VOC contents.

The tables below also show that VOC emission reductions in the non-SCAQMD portion

of California would be virtually zero from implementing the proposed limit of 120 g/l for low solids coatings.

Table D-18a
Low Solids Stains*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
120	PD	100	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
PD = Protected Data.

Table D-18b
Low Solids Wood Preservatives*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
120	PD	100	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
PD = Protected Data.

Issues:

1. Issue: In the definition for low solids coating, at least half of the volatile component is water. It is unclear whether this requirement is by weight or by volume.

Response: In an earlier version of the proposed SCM, we had included the language from the National Rule requiring that at least half of the volatile component be water. We have dropped that requirement to allow for the use of either exempt solvents or water in the formulation of low solids products.

2. Issue: Industry needs limits for low-solids stains and preservatives, as well as low-solids waterproofing sealers and general sealers.

Response: The suggested low solids products are included in the category. We have named the category "low solids coatings" to allow formulation of other types of low solids products such as these coatings.

3. Issue: The low-solids definition in the National Rule doesn't specify whether the half of the volatile component is water by weight or volume; we assume it's by volume. The definition should say "water or exempt compounds." This definition is considerably at variance with the definition in Rule 1113 and the National Rule.

Response: The commenter refers to a previous version of the SCM in which we used the National Rule definition that included the 50 percent water requirement and did not allow the use of exempt compounds. This definition was different from the SCAQMD definition in Rule 1113. The proposed definition is now identical to the definition in several district rules and does

not exclude the use of exempt solvents.

4. Issue: The definition for low-solids coatings should include earlier proposed language limiting low-solids coatings to those with water comprising half of the volatile component, unless this is considered redundant.

Response: The proposed definition matches the definition in several existing district rules. Under the proposed definition, low-solids coatings must include a large percentage of water or exempt solvents to qualify for inclusion in the category.

REFERENCES

Air Resources Board, Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

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15. Multi-Color Coatings

Product Category Description:

Multi-color coatings are coatings packaged in a single container that, when applied in one layer, exhibit more than one color. They are designed for use as a substitute for wallpaper in offices, hotels, hospitals, and other public buildings. The individual colored pigment flecks are suspended in a base of a contrasting color, and when sprayed on a surface, produce a speckled, textured surface. These coatings are durable enough to withstand repeated washings (SCAQMD, 1996; LeSota, 1995; Coronado Paint, undated).

Table D-19 below summarizes our estimate of sales and VOC emissions from the multi-color coatings category.

Table D-19
Multi-Color Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based***	PD	PD	520	~0.00
Water-Based	PD	PD	268	0.04
Total	22	40,224	263	0.04

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.
******* Includes 100 percent solid coatings.
PD = Protected Data.

Product Use and Marketing:

Multi-color coatings are not a do-it-yourself item, and are sold by distributors or direct from the manufacturer to the end user. These products are a specialty item applied by professional contractors who specialize in applying multi-color coatings.

Multi-color coatings are spray applied, but the manufacturer's recommendation must be followed on the type of spray system that should be used. Stirring should also follow the manufacturer's directions to avoid disrupting the suspended contrasting color particles. Also, color uniformity batch-to-batch may be more challenging with these coatings than with other coatings. It is possible for the applicator to achieve an individual stylized effect by using different background shadings, blending different colors, or using different application techniques. Multi-color coatings can be used on drywall, wood, masonry, steel, galvanized metal, aluminum, and wallpaper, provided the proper surface preparation and primers are used. Touch-up also must be done following the manufacturer's recommendations. A clear coat can be applied on top of the multi-color coating to give a glossy surface or a slight shine, and to improve scrubbability and abrasion resistance (Coronado Paint, undated).

Product Formulation:

There are a number of high-VOC solvent-based coatings, as well as several complying water-based formulations reported in the 1998 ARB Architectural Coatings Survey.

The SCAQMD performed a technology assessment of these coatings during development of its 1996 amendments to Rule 1113. Water-based formulations using a modified acrylic resin system have the same properties as the older solvent-based alkyd or lacquer resin technology. Manufacturers reported some difficulty with reformulating metallic multi-color coatings, but were able to reformulate prior to January 1998, the effective date of the SCAQMD's 250 g/l VOC limit (SCAQMD, 1996).

The ARB concurs with the SCAQMD's conclusions based on its own investigation. ARB staff contacted three manufacturers of multi-color coatings. Two of the manufacturers are currently selling water-based products that are acceptable substitutes for their solvent-based formulations. The VOC contents are at or below 250 g/l. The third manufacturer is in the final stages of development of a water-based, complying product that will be available for the January 1, 2003, compliance date of the SCM.

Proposed VOC Limit and Basis for Recommendation:

The proposed 250 g/l VOC limit is technologically and commercially feasible by the January 1, 2003, effective date based on: complying market share; discussions with manufacturers who have or will soon have complying products; the limit in effect in the South Coast and Antelope Valley districts; and the technology assessment performed by the SCAQMD in 1996.

Lower-VOC water-based technology is available and has been commercially accepted as a viable alternative to the higher-VOC, solvent-based multi-color coatings. Reformulation efforts to achieve compliance with the proposed limit will continue to focus on replacing solvent-based formulations with water-based products. One manufacturer noted that many contractors prefer water-based multi-color coatings because they are less hazardous to apply, and they can be used in healthcare facilities where solvent odor must be minimized.

The table below also shows that VOC emission reductions in the non-SCAQMD portion of California would be approximately zero tons per day, on an annual average basis, from implementing the proposed limit of 250 g/l.

Table D-20
Multi-Color Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
250	13	65.80	0.01

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Issues:

1. Issue: "Applied in a single coat" is not clear in the category definition. That might mean that someone couldn't put a second coat on. Should change to "that exhibits more than one color when applied in a single coat."

Response: We have changed the wording of the definition to clarify that the coating exhibits more than one color when applied in a single coat.

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LeSota, Stanley (ed.). *Coatings Encyclopedic Dictionary.* Federation of Societies for Coatings Technology. 1995. (LeSota, 1995)

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16. Primer, Sealer, and Undercoater Coatings

Product Category Description:

The primer, sealer, and undercoater category is a generic term used to describe coatings, typically the initial coat, used to provide a smooth surface for subsequent coats. Primers, sealers and undercoaters are also used to provide a shield between the substrate and the subsequent coat or to provide adhesion for the topcoat. (SCAQMD 1999).

This category excludes specialty primers, which are those products formulated to block stains, or for application to substrates damaged by fire, smoke, or water, or to condition excessively chalky surfaces. This category also excludes primer, sealer and undercoater products that are dry to the touch in 30 minutes and can be recoated in 2 hours. These products fall under the category of quick-dry primer, sealer, and undercoater coatings.

The National Rule has one category for primers and undercoaters, and another category for sealers. (U.S. EPA, 1998) Because of the trend toward multi-functional products that are primers, sealers, and undercoaters, we have grouped these products, with the exceptions noted above, into one category. This is also how most district rules treat these coatings.

Table D-21 below summarizes our estimate of sales and VOC emissions from the primer, sealer, and undercoater coatings category. These numbers are a compilation of two product categories surveyed in the 1998 ARB Architectural Coatings Survey- Primers, Sealers, and Undercoaters; and Sealers (ARB, 1999).

In 1996, nearly 900 products were sold in California by 81 companies, accounting for over 6 million gallons of product per year. Approximately 55 percent of the sales are water-based products, and 45 percent of the sales are solvent-based products. The sales weighted average (SWA) VOC content for all products in this category is 169 g/l; water-based products have a SWA VOC content of 105 g/l, and solvent-based products have a SWA VOC content of 360 g/l. The VOC emissions for water-based products, excluding those emissions occurring in the SCAQMD, are 1.2 tons per day (tpd), and the VOC emissions for solvent-based products is 3.4 tpd, yielding non-SCAQMD VOC emissions of 4.6 tpd for the category.

Please note that the specialty primer category was not surveyed as a separate category, and some of the products reported in the primer, sealer, undercoater category are actually specialty primers.

Table D-21
Primer, Sealer, and Undercoater Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	398	1,573,273	360	3.39
Water-Based	493	4,689,604	105	1.19
Total	891	6,262,877	169	4.59

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.

Product Use and Marketing:

Primers, sealers, or undercoaters are particularly useful when coating new wood or other surfaces that have not been previously coated, when recoating a surface that is uneven or badly deteriorated, and when coating a surface that has been stripped or is worn down to the original surface. (PQI,a) The use of these products will reduce the incidence of cracking and flaking, which may occur when coating is applied directly to the substrate. (PQI, b)

Traditionally, there have been specific coatings for a variety of uses, including priming, sealing, stain blocking, and hiding. Furthermore, specific coatings were formulated for different substrates, including wallboard, plaster, concrete, masonry block, pipe insulation, and coated glossy and non-glossy surfaces. However, the recent trend has been to develop multi-functional primers that can be used for a variety of substrates. (SCAQMD 1999)

Primers, sealers and undercoaters are applied to a wide variety of substrates, including, but not limited to, brick, ceramic tile, cinder block, concrete, cured plaster, Masonite®, metal, fiberglass, Formica®, glass, vinyl siding, stucco, wallcoverings, as well as previously coated surfaces.

Primers, sealers and undercoaters can be purchased by all consumers at outlets such as hardware stores, home supply stores, and retail paint stores, and by professionals at wholesale only outlets.

Surface preparation is the most important step in any coating application because it directly affects the durability and appearance of the completed job. Coatings manufacturers develop surface preparation recommendations for their products and provide these recommendations to the consumer by printing them in their literature and product labels. Most companies consider these methods to be minimum requirements for a satisfactory job, and by following these recommendations the consumer is assured a satisfactory job under most conditions. (McNeill)

General surface preparation calls for all surfaces to be clean and dry. All dirt, dust, rust, stains, scale, mildew, wax, grease, oil, bond-breakers, efflorescence, and other contaminants that can adversely affect the coating adhesion and performance should be removed, as should all

loose, peeling, or checked paint. Glossy surfaces should be deglossed. (Dunn-Edwards)

Product data sheet review indicates that the minimum recommended application temperature (air, surface, and product) for primers, sealers, and undercoaters ranges from 40° F to 50° F, depending upon the formulation. Problems such as "ghosting", "mud cracking", and other film irregularities can occur if the proper product is not chosen for the range of application. (Bennette, a) A review of product data sheets for primer, sealer, and undercoater products indicated that most latex products recommend a minimum application temperature of 50°F, and most alkyd products recommend a minimum application temperature of 40°F.

Manufacturer's recommendations for maximum application temperature must also be adhered to, as painting in hot weather can also result in less than satisfactory results. While most manufacturers do not indicate a recommended maximum application temperature, some specify maximum application temperatures as high as 120°F, while others specify maximum application temperatures as low as 85°F. Temperatures exceeding 90°F will often cause a coating to dry too fast, and "dry rolling" will be accentuated at higher temperatures, and painting in direct sunlight at temperatures above 90°F may cause surface wrinkling. (Bennette, b) Primers, sealers, and undercoaters may be applied by brush, coating pad, roller, airless sprayer, high-volume low-pressure sprayer, or electrostatic sprayer.

Depending on the porosity of the substrate, coverage per gallon typically ranges from 250 to 450 square feet. In addition to the porosity of the substrate, coverage is also influenced by the amount of solids and hiding pigment in the coating. (Dunn-Edwards) These products are to be stirred thoroughly prior to use, and stirred occasionally during use. The product should be applied liberally and spread evenly and quickly, working from wet area to dry area to avoid lapping, and allowed to dry for the recommended time prior to recoating.

In addition to a minimum recoat or topcoat time, some manufacturers recommend a maximum recoat time for primers, sealers, and undercoaters. After they are applied, these products can begin to weather and harden. If not topcoated within a reasonable time, they can become too hard or weathered to allow the topcoats to penetrate and adhere, and peeling may result. This situation occurs mostly with oil based or other solvent-based primers; affected products will have a statement on the product label and information sheet stating the recoat "time window." Water-based acrylic primers will generally not become too hard to allow for proper adhesion of the topcoats, however, if they are not topcoated within a reasonable time, they can begin to weather, which can cause adhesion problems. (Dunn-Edwards)

Product Formulation:

This category includes a variety of available coating technologies in its formulations; alkyds, modified alkyds, oleoresins, epoxies, specialty resins, and emulsions are just a few of the formulations used. (SCAQMD 1999).

Coatings ingredients fall into four basic categories:

- Pigments to provide color and hide;
- Binder to hold the pigment particles together and provide adhesion;
- Liquid to act as a carrier for the pigments and binder; and
- Additives to enhance certain properties like brushing ease and mildew resistance (PQI,c).

As indicated previously, over half of the products reported in the 1998 ARB survey are water-based, that is, water is the liquid that acts as the carrier for the pigments and binder. The binder consists of a dispersion of fine particles of synthetic resin, and so the products are also referred to as latex coatings. Latex binders may be acrylic, vinyl chloride, vinyl acetate, styrene, or a combination of these materials in a single resin. (PQI,c) The largest contributors of VOCs in latex coatings are glycols, whose main purpose is to provide freeze/thaw resistance, and coalescence.

In alkyd and oil-based coatings, most of the liquid is a solvent, usually a petroleum distillate. The solvent-based coatings in this category are commonly formulated using alkyd resins as binders.

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit for the primer, sealer, undercoater category is 200 g/l. The proposed VOC limit is technologically and commercially feasible by the January 1, 2003, effective date based on our review of product data sheets, analysis of complying market share, information provided by manufacturers, and laboratory performance tests as described below. Our recommended limit is consistent with the interim limit adopted by the SCAQMD in Rule 1113.

Industrial maintenance coatings recommended for use as primers, sealers, or undercoaters are subject to the proposed VOC content limit for industrial maintenance coatings (250 g/l). The National Rule VOC limit for primers and undercoaters is 350 g/l, and the VOC limit for sealers is 400 g/l.

The 1998 ARB survey, the national survey, and the SCAQMD staff survey of product data sheets all indicate that compliant primers, sealers, and undercoaters are commercially available and command a large market share.

Data reported in the 1998 ARB survey indicate that 73 percent of the products sold in California already comply with the proposed VOC limit of 200 g/l. We estimate emission reductions of 0.77 ton per day VOC from the proposed limit for the areas outside of the SCAQMD.

Table D-22
Primer, Sealer, and Undercoater Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
200	445	73	0.77

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

To meet the proposed VOC limit, manufacturers can employ water-based technology, and achieve further reductions in water-based technology through the use of lower VOC coalescing solvents and freeze/thaw resistance additives.

The Sherwin-Williams Company, in their 1998-1999 Painting & Coating Systems catalog for Specifiers and Applicators, includes numerous primers, sealers, and undercoaters that comply with the proposed limit. A few of these are discussed below.

Sherwin-Williams' Loxon Exterior Acrylic Masonry Primer (A24 Series) is recommended for masonry, cement, and stucco, and has a VOC of only 60 g/l. The product data sheet indicates that this primer passes moisture resistance, wind-driven rain, moisture vapor permeability, flexibility, tensile strength, alkali resistance, and mildew resistance tests. (SCAQMD, 1999)

Sherwin-Williams' PrepRite 200 and 400 Interior Latex Primer are considered their professional best line, and good quality, professional line, respectively. Both of these products have VOC contents that are below the proposed limit. The product data sheets indicate that these products prime and seal, have excellent holdout, and accept latex, alkyd, and waterborne epoxy topcoats. Their PrepRite Classic Interior Latex Primer, also with a VOC content below the proposed limit, is indicated as "our finest quality primer and sealer, designed for use on interior wood, drywall and masonry/concrete surfaces, providing excellent enamel hold out for any recommended topcoat and excellent sanding characteristics." It is recommended as a high quality wall primer or enamel undercoater. Their PrepRite ProBlock Latex Primer/Sealer has the same low VOC content, is recommended for both interior and exterior uses, has excellent adhesion to hard, slick, or glossy surfaces, and can be topcoated with a latex or alkyd topcoat. Their catalog includes several, additional primers for both interior and exterior uses. The VOC content information provided above is for white coatings only. (SCAQMD, 1999)

Insl-X, Zinsser, and Zehrung have developed and marketed zero- and low-VOC primers, sealers, and undercoaters recommended for a variety of uses. (SCAQMD, 1999)

Harlan Study

In 1995, Harlan Associates tested 20 different primers/sealers. In this test, only two of the twenty coatings tested qualify as "quick-dry primers" as defined by several district rules. According to these tests, most of the low VOC primers had performance characteristics similar to the high-VOC primers. The following tests showed relatively equivalent results including:

- Stability
- Application
- Adhesion
- Appearance
- Dry-to-Touch Time
- Flexibility
- Grain Raising
- Sag Resistance
- Alkali Resistance

Two differences were noted between the low-VOC and high-VOC primer/sealers; freeze-thaw resistance and dry-to-recoat times. The freeze-thaw resistance test is used to determine the resistance of a coating to storage in very cold temperatures and only affects water-based coatings. Nine out of twelve low-VOC coatings passed this test. Also, ten of the twelve low-VOC coatings tested had acceptable dry-to-recoat times of 6 hours or less. (ARB, 1995; Cowen, 1999)

NTS Study

ARB staff's analysis of the National Technical Systems (NTS) data from the SCAQMD's "Phase II Assessment Study of Architectural Coatings" indicates that overall, low-VOC primer, sealer, and undercoater coatings exhibited similar performance to high-VOC primer, sealer, undercoater coatings. This study evaluated the performance characteristics of primers, sealers, and undercoaters for a variety of characteristics, including brushing properties, dry times, leveling, sag resistance, hiding, and film thickness. (NTS, 1999)

Issues:

1. Issue: As currently written, the primers category would include those made from bituminous resins. Bituminous primers should be separately defined or should be included in the bituminous coatings category at the federal level.

Response: Bituminous roof coatings are defined as a coating labeled and formulated for roofing that incorporates bitumens. Bituminous primers would be included in that coatings category. Please refer to the section on bituminous roof coatings for further information.

2. Issue: The primer, sealer, and undercoater category should be divided/categorized into the following: interior primers and undercoaters; exterior primers and undercoaters; interior sealers; and exterior sealers.

Response: As indicated by product labels and product data sheets, many of the products in the primer, sealer, undercoater category are intended for use on interior and exterior surfaces. The 1998 ARB survey indicates that 41 percent of the products reported in this category are for interior use, 31 percent are for exterior use, and 28 percent can be used on either interior or exterior surfaces. For the sealer category, which was surveyed separately, the survey indicates that 61 percent of the products are for interior use, 26 percent are for exterior use, and 14 percent can be used on either interior or exterior surfaces. Further, the trend toward multi-use products

has resulted in products for which there is no clear-cut distinction between products that seal and products that prime or undercoat. Subcategorization of the primer, sealer, undercoater category into exterior and interior and sealer vs. primer or undercoater would create artificial categories for which very few products exist.

3. Issue: A specialty primer category with a VOC content of 350 g/l should be established. We sell three specialty primers that are used to prime poured-in-place concrete and tilt-up concrete. The product is designed to go through form oils and release agent materials that are used in the forming of the concrete and remain on the surface of the concrete. Lower VOC products (including latex systems) cannot penetrate these materials and provide the required adhesion.

Response: Concrete should be allowed to cure for 30 to 60 days before coating, and the moisture content should be no higher than 15 percent to ensure success. Moisture is a common cause of coatings failing to properly adhere on concrete. If moisture can penetrate cured concrete it will leach out alkaline salts that can react with the resin in many coatings causing early adhesion failure. A test for moisture migration should be conducted if a moisture condition is suspected.

Release compound is formulated to weather off within a relatively short time, and should decompose by the time the concrete has cured to the correct moisture content. It is only necessary to brush off the decomposed release compound before coating. Release compound not decomposed by weathering must be removed before coating for proper adhesion. Water or abrasive blasting will effectively remove release compound.

A review of product data sheets indicates there are products for the specific applications indicated by the commenter that comply with the proposed standard. For all but one product, use instructions direct the applicator to allow the concrete to fully cure, as specified above.

4. Issue: We have two specialty solvent-based primers designed to go over less than ideal wood surfaces and chalky coating. The higher VOC (350 g/l) solvent primers penetrate the chalky surfaces and provide excellent adhesion for subsequent topcoats. Other surface types requiring specialty primers with VOC levels of 350 g/l are galvanized metal, aluminum, copper, stainless steel, ferrous metal, and baked enamels.

Response: We are proposing a specialty primer category with a VOC limit of 350g/l to address these issues.

5. Issue: We feel the categories of quick dry primers, sealers and undercoaters should be reinstated.

Response: The Quick-dry primer, sealer, and undercoater category exists in this proposed SCM. However, it should be noted that the proposed VOC limit for the quick-dry primer, sealer, undercoater category is the same as the proposed VOC limit for the primer, sealer,

undercoater category. Please refer to the section on quick-dry primers, sealers, and undercoaters for further information.

6. **Issue:** In the SCAQMD rule, they provided a higher VOC limit for specialty primers applied to chalky substrates. We propose a stain blocking primer, or including stain blocking in the specialty primer definition. Woods have tannins that bleed through water-based products.

Response: We have created a specialty primer category with a VOC limit of 350 g/l for primers applied to block tannins and other stains, and to condition excessively chalky surfaces. Please refer to the section on specialty primers for further information.

7. **Issue:** The definition for sealers precludes sealers which are used to seal a substrate to protect it from penetration of foreign matter but which are not topcoated. This needs to be corrected.

Response: We do not agree. Primers, sealers, and undercoaters in district rules have always been defined as a primary coat which is topcoated. Primers, sealers, and undercoaters are grouped together for this reason. We are proposing 250 g/l VOC limits for sealers designed as topcoats, such as waterproofing sealers for wood or concrete. Please refer to the waterproofer sealers category descriptions.

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17. Quick-Dry Enamel Coatings

Product Category Description:

Quick-dry enamel coatings are high gloss coatings designed to dry quickly. They are used on interior and exterior surfaces of residential and commercial buildings. Quick-dry enamels are a subcategory of non-flat coatings (see the non-flat category description). In order for a non-flat coating to be classified as a quick-dry enamel, it must be dry to touch within two hours after application, be tack-free within four hours, and dry hard within eight hours. It must also have a gloss of 70 or above on a 60^{o} meter.

Table D-23 below summarizes our estimate of sales and VOC emissions from the quick-dry enamel coatings category based on the 1998 ARB Architectural Coatings Survey results. This category is the seventh largest coatings category with regard to VOC emissions and the fifteenth largest category with regard to sales volume. The VOC emissions from quick-dry enamels represent about 4 percent of the total emissions from architectural coatings (ARB, 1999). VOC emissions in California, excluding the SCAQMD, are approximately 2.3 tons per day. As shown below, all of the emissions from this category are from solvent-based products.

Table D-23
Quick-Dry Enamel Coatings*

	Number of Products	Category Sales (gallons/year)	Sales-Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	154	904,739	403	2.24
Water-Based	0	0	N/A	N/A
Total	154	904,739	403	2.24

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.

Product Use and Marketing:

As with other non-flat coatings, quick-dry enamels can be brushed, rolled, or sprayed on the surface to be coated. "Do-it-yourselfers" and paint contractors can purchase coatings that meet the quick-dry enamel criteria at outlets including hardware stores, home supply stores, and retail paint stores. Quick-dry enamels are typically used where the coated surface needs to dry quickly to minimize dust contamination (e.g., new home construction) or the area needs to be returned to service quickly (e.g., restaurants) (SCAQMD, 1999). As with other non-flat coatings, quick-dry enamels may be used on surfaces where frequent cleaning is necessary and in rooms where moisture is present. Kitchens, bathrooms, hallways, children's rooms, doors, window frames, shutters, and wood trim may be coated with such coatings. Commercial buildings and institutions may use quick-dry enamel coatings on surfaces such as walls, corridors, and

stairwells. With proper surface preparation and priming (if necessary), quick-dry enamels can be used on a large variety of interior and exterior substrates including drywall, plaster, masonry, wood, and metal.

The 1998 ARB survey showed that about 22 percent of the quick-dry enamels sold in 1996 were formulated for interior applications, 4 percent for exterior applications, and 74 percent were formulated for both interior and exterior applications (ARB, 1999).

Product Formulation:

As previously mentioned, all of the coatings reported under the "quick-dry enamel" category in the 1998 ARB survey were solvent-based. Quick-dry enamels are typically formulated using alkyd resins as binders. The amount of quick-dry enamels sold has increased approximately 87 percent since the 1993 ARB survey of architectural coatings (which reflected 1990 sales). Past ARB surveys show a large fluctuation in the volume of quick dry enamel coatings sold (ARB, 1991; ARB, 1986). The overall sales-weighted average VOC level for quick-dry enamels has remained the same since 1990, and all of the products reported in this category have remained solvent-based (ARB, 1999).

Product information sheets published by coatings manufacturers indicate that there are a number of lower-VOC, water-based latex coatings available that meet the gloss and dry time criteria of quick-dry enamels, although those products may not be labeled as quick-dry enamels. Those products are discussed in more detail below.

Proposed VOC Limit and Basis for Recommendation:

We recommend a 250 g/l VOC limit for quick-dry enamel coatings, effective January 1, 2003. The proposed VOC limit is technologically and commercially feasible by January 1, 2003, based on our review of ARB survey data on market shares, product information from manufacturers, and laboratory performance tests. The proposed VOC limit is lower than the 450 g/l national limit recently promulgated by the U.S. EPA (U.S. EPA, 1998). The most common limit for quick-dry enamels currently in effect for those California air pollution control districts that have architectural coatings rules is 400 g/l. Since September 1990, the Santa Barbara County Air Pollution Control District has had a 250 g/l limit for quick dry enamels in their architectural coatings rule. In 1999, the SCAQMD adopted a 250 g/l limit for quick dry enamels that will become effective July 1, 2002, and also adopted a 50 g/l limit that will become effective July 1, 2006. Our recommended limit is consistent with the interim limit adopted by the SCAQMD.

Table D-24 does not present specific data regarding the market share of products that comply with the proposed limit due to confidentiality concerns (ARB, 1999). It is important to point out that manufacturers in the past have typically marketed only solvent-based alkyd coatings as quick-dry enamels. However, as discussed below, a number of water-based latex coatings that comply with the proposed limit meet the gloss and dry-time requirements of this category. We expect that, in order to meet the proposed limit, most solvent-based alkyd products would be reformulated as water-based latex products. More information on the formulation of water-based latex products can be found in the non-flat category description. Coating

manufacturers may also choose to reformulate solvent-based alkyd products using existing low-VOC alkyd technology (e.g.,Vianova Resins, 1999).

The table below shows that VOC emission reductions in the non-SCAQMD portion of California would be approximately one ton per day, on an annual average basis, from implementing the proposed limit of 250 g/l.

Table D-24
Quick-Dry Enamel Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
250	PD	PD	0.99

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
PD = Protected Data.

Product information from manufacturers

A number of products that are currently available satisfy the quick-dry enamel criteria and meet the proposed VOC limit. Product information sheets published by coatings manufacturers indicate that a number of coatings meet the gloss and dry time criteria of quick-dry enamels and have VOC levels at or below 250 g/l. The products we identified are all water-based, but the 250 g/l limit may not exclude all solvent-based coatings. At the end of this discussion are tables of information about specific products that meet the proposed VOC limit and, for comparison, products that exceed the proposed limit. We identified specific high-gloss quick-drying products with a VOC content of 250 g/l or less offered by Dunn Edwards, Evr-gard, ICI Dulux, Kelly Moore, and Sherwin-Williams. A list of performance characteristics compiled from product information sheets for such coatings is presented below and includes characteristics of products formulated for interior, exterior, and interior/exterior uses. Please note that not all high gloss, quick-drying coatings with VOC levels at or below 250 g/l possess all of the characteristics listed below:

High gloss, quick-drying coatings
professional best finish, highest premium finish, premium quality
very good non-blocking characteristics
excellent gloss retention
excellent color retention
alkyd-like hardness and durability
durable, exceptional toughness and durability, durable protection
dries quickly and cures to a washable finish
abrasion resistant
stands up to harsh use on interior surfaces
tough wear-resistant and weather-resistant finish
non-yellowing
high hiding
easy application
excellent adhesion to aged alkyd enamels, excellent adhesion even to difficult surfaces

resists blistering, peeling , and flaking
equal to alkyd enamels for flow and leveling characteristics, excellent flow and leveling

NTS Study

Independent laboratory performance tests of a number of coatings were recently conducted by National Technical Systems (NTS) under contract with the SCAQMD. Included in those tests were eight coatings with VOC levels at or below 250 g/l (range: 0 to 250 g/l) that meet the gloss and dry time criteria of quick-dry enamels. NTS also tested 5 coatings that were labeled as quick-dry enamels that had VOC levels of
400 g/l. Although three of the five 400 g/l coatings did not appear to meet the gloss criterion, they will be included in this comparison. For this discussion, those coatings that comply with the proposed 250 g/l limit ("low-VOC coatings") are compared with the 400 g/l coatings ("high-VOC coatings"). Similar performance for low-VOC and high-VOC coatings was seen in tests of brushing properties and film thickness. The high-VOC coatings had somewhat better leveling performance, but the low-VOC coatings performed better with regard to sag resistance. Block resistance tests for the interior coatings showed that some of the best-performing coatings were in the low-VOC category. Block resistance for exterior coatings was somewhat better for high-VOC coatings. Low and high-VOC interior coatings had similar results in tests for dirt removal ability. High-VOC interior coatings generally showed better scrub abrasion resistance, although one low-VOC coating had the best performance in this test (NTS, 1999).

Harlan Study

In 1995, Harlan Associates, Inc., under contract with ARB, conducted performance tests on 10 interior and 10 exterior non-flat coatings. Those coatings were selected in 1994 from commercially available coatings. The VOC levels of the twenty coatings ranged from 15 g/l to 459 g/l. Inspection of the gloss levels and dry times of the coatings as measured in the tests indicates that three complying interior coatings and three complying exterior coatings met the gloss and dry-time criteria for quick-dry enamels. Some of the coatings that were labeled as quick-dry enamels did not meet the criteria.

For the three interior coatings that met the quick-dry enamel criteria, all were water-based and had VOC levels that ranged from 178 g/l to 209 g/l. The three exterior coatings that met the quick-dry enamel criteria were also all water-based, and had VOC levels that ranged from 183 g/l to 257 g/l; the high end of that range is just over the proposed limit of 250 g/l ("low-VOC coatings"). There was one interior coating and four exterior coatings tested that had VOC levels above 250 g/l ("high-VOC coatings") from which to compare performance characteristics.

The results suggest that the low-VOC coatings had performance characteristics similar to the high-VOC coatings with regard to stability, hardness, application, adhesion, appearance, abrasion resistance, flexibility, accelerated weathering, impact resistance, and fungus resistance. In addition, the low-VOC coatings appeared to perform better than the high-VOC coatings with regard to accelerated yellowing and sag resistance. On the other hand, the high-VOC coatings appeared to perform better overall with regard to blocking resistance, although there was a high degree of variability in the results of this test, with some high-VOC products showing poor performance in this area and some low-VOC coatings showing good performance.

(ARB, 1995; Cowen, 1999).

Issues:

1. Issue: Water-based enamels don't dry fast enough, are not high enough in gloss, and don't have enough block resistance to be used in areas where quick-dry enamels are typically used.

Response: We were able to identify, through product information sheets published by coatings manufacturers, a number of coatings that meet the gloss and dry time criteria of quick-dry enamels and have VOC levels at or below 250 g/l. One of those coatings was described as having very-good non-blocking characteristics, demonstrating that current technology provides the ability to include such characteristics in a coating formulation.

In addition, independent laboratory studies conducted by NTS and Harlan and Associates identified commercially-available coatings with VOC levels at or below 250 g/l that meet the gloss and dry time criteria of quick dry enamels. Results of laboratory tests of block resistance for those lower-VOC coatings (giving the most weight to the recent NTS tests which better reflect current technology) indicate that some of the lower-VOC coatings tested performed as well or better than high-VOC coatings. Those results show that some manufacturers have been able to formulate and market high gloss, quick drying coatings with good block resistance that meet the proposed 250 g/l limit.

2. Issue: The 1989 version of the SCM (ARB, 1989) recommended that the quick-dry enamel category be eliminated. This category was considered a popular loophole for manufacturers attempting to sidestep more aggressive controls. CARB should re-evaluate the benefit of reinstating this category and its VOC limit in the SCM.

Response: The recommended VOC limit for this category will drop from the 400 g/l limit currently found in most district rules to 250 g/l. This will eliminate the use of the quick-dry enamel category as a possible loophole. Our technical assessment indicates that there is still a need for this category for circumstances when a quick-drying, high-gloss coating with good block resistance is needed (e.g. when doors or windows are coated and need to be shut fairly soon thereafter for security reasons).

3. Issue: Bathtub refinishing products have in the past been included in the quick-dry enamel category. They used to be called "tile-like glaze." The 250 g/l limit would be a problem for these coatings.

Response: Bathtub, shower, and sink refinishing products are commonly supplied in quart or smaller sized containers, which are exempt from the proposed SCM. Thus, those product types are not affected by the proposed limit. This conclusion is consistent with the 1989 SCM, in which staff recommended that the "tile like glaze" category be excluded from the SCM.

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Vianova Resins, Technical Update, “High Gloss Enamels with RESYDROL®, Acrylic-Modified Alkyd Emulsions that Exceed Traditional Alkyd Performance.” (Vianova Resins, 1999)

18. Quick-Dry Primer, Sealer, and Undercoater Coatings

Product Category Description:

The quick-dry primer, sealer, and undercoater category is a generic term used to describe coatings, typically the initial coat, used to provide a smooth surface for subsequent coats or to provide a shield between the substrate and the subsequent coat or to provide adhesion for the topcoat. By definition, the dry to touch time needs to be less than 30 minutes, and the recoat time needs to be less than two hours, both tested by ASTM Method D 1640 (SCAQMD 1999).

The National Rule defines this category as follows: "Quick-dry primer, sealer, and undercoater means a primer, sealer, or undercoater that is dry to the touch in ½ hour and can be recoated in 2 hours when tested in accordance with ASTM Method D 1640-83 (Reapproved 1989), Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature." (U.S. EPA, 1998)

Table D-25 below summarizes our estimate of sales and VOC emissions from the quick-dry primer, sealer, and undercoater coatings category based on products reported in the ARB's 1998 Architectural Coatings Survey. (ARB, 1999) Thirty-six companies reported a total of 150 products, which accounted for sales of nearly two million gallons per year in California. The sales-weighted average VOC content of all reported products is 303 g/l and the VOC emissions outside of the SCAQMD totaled 3.3 tons per day. Solvent-based products account for approximately 56 percent of the total sales volume, and 89 percent of the emissions. Water-based products account for the remaining 44 percent of the sales volume and 11 percent of the category emissions.

Please note that the specialty primer category was not surveyed separately, and some of the products reported in the quick-dry primer, sealer, undercoater category are actually specialty primers.

Table D-25
Quick-Dry Primer, Sealer, and Undercoater Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	112	1,076,267	432	2.90
Water-Based	38	836,648	136	0.37
Total	150	1,912,915	303	3.27

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.

Product Use and Marketing:

Products in the quick-dry primer, sealer, undercoater category are typically used where the substrate to be coated needs to dry quickly to minimize dust contamination, such as new home construction, or be returned to service quickly, such as a restaurant. (SCAQMD 1999) Specialty primers can be purchased by all consumers at outlets such as hardware stores, home supply stores, and retail paint stores, and by professionals at wholesale-only outlets.

Please refer to the chapter on primers, sealers, and undercoaters for additional information on general surface preparation, product application recommendations, and product coverage.

Product Formulation:

This category utilizes a variety of available coating technologies in its formulations; alkyds, modified alkyds, oleoresins, epoxies, specialty resins, and emulsions are just a few of the formulations used. (SCAQMD 1999).

Coatings ingredients fall into four basic categories:

- Pigments to provide color and hide;
- Binder to hold the pigment particles together and provide adhesion;
- Liquid to act as a carrier for the pigments and binder; and
- Additives to enhance certain properties like brushing ease and mildew resistance. (PQI)

In alkyd and oil-based coatings, most of the liquid is a solvent, usually a petroleum distillate. The solvent-based coatings in this category are commonly formulated using alkyd resins as binders. While nearly three times as many solvent-based products as water-based products were reported in the 1998 ARB survey, by volume the solvent-based products account for approximately 56 percent of the sales in this category.

Approximately 44 percent of the volume of quick-dry primer, sealer, undercoater products reported in the 1998 ARB survey are water-based, that is, water is the liquid that acts as the carrier for the pigments and binder. The binder consists of a dispersion of fine particles of synthetic resin, and so the products are also referred to as latex coatings. Latex binders may be acrylic, vinyl chloride, vinyl acetate, styrene, or a combination of these materials in a single resin. (PQI) The largest contributors of VOCs in latex coatings are glycols, whose main purpose is to provide freeze/thaw resistance, and coalescence agents.

Proposed VOC Limit and Basis for Recommendation:

The recommended VOC limit for quick-dry primer, sealer, and undercoaters is 200 g/l. The proposed VOC limit is technologically and commercially feasible by the January 1, 2003, effective date based on our review of product data sheets, analysis of complying market share, information provided by manufacturers, and laboratory performance tests as described below. Our recommended limit is consistent with the interim limit adopted by the SCAQMD. The National Rule Limit is 450 g/l (U.S. EPA, 1998), as is the most common district

limit, most of which have been in effect for many years. Several districts have no limit for this category.

To meet the proposed VOC limit, manufacturers can employ water-based technology, and achieve further reductions in water-based technology through the use of lower VOC coalescing solvents and freeze/thaw resistance additives. The 1998 ARB survey data indicate that compliant, quick-dry primers, sealers, and undercoaters are commercially available. Almost 44 percent of the quick-dry primers, sealers, and undercoaters from the survey are water-based formulations, and have a sales weighted average VOC content of 136 g/l. On a total volume basis, in 1996, 35 percent of the volume of quick-dry primers, sealers, and undercoaters was below the proposed 200 g/l VOC content limit. These include products recommended for interior, exterior, and dual interior/exterior uses. We estimate a VOC reduction of about one ton per day from the proposed limit in the non SCAQMD portion of the State.

Table D-26
Quick-Dry Primer, Sealer, and Undercoater Coatings*

Proposed VOC Limit (g/l)	No. of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
200	19	34.6	1.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Harlan Study

A study conducted by Harlan and Associates for the ARB in 1995 analyzed a large number of coatings listed as quick-dry primers, sealers, and undercoaters, and concluded that most of the coatings labeled as 'quick-dry' did not meet the definitional requirements and thus should not be classified as such. In addition, the study concluded that some of the water-based technology included in the testing actually met the requirements of a quick-dry coating, but were not necessarily listed as a quick-dry coating. (SCAQMD 1999)

Harlan Associates tested 20 different primers/sealers. These coatings were also selected to determine the need for the "quick-dry" primer, sealer and undercoater category. In the 1989 SCM, there was no "quick-dry" category, which effectively limited the VOC content for these coatings to 350 g/l (the same limit as primers, sealers, and undercoaters).

In this study, only two of the twenty coatings tested qualified as "quick-dry primers" as defined by several district rules. The remainder of the coatings dried too slowly to be classified as quick-dry (more than 30 minutes to touch or more than 2 hours to recoat).

In this testing, the performance of the high-VOC quick-dry primer/sealers versus the low-VOC quick-dry primers/sealers was essentially equivalent for a number of critical areas. Most of

the low-VOC primers had performance characteristics similar to the high-VOC primers. The following tests showed relatively equivalent results including:

- Stability
- Application
- Adhesion
- Appearance
- Dry-to-Touch Time
- Flexibility
- Grain Raising
- Sag Resistance
- Alkali Resistance

Two other differences were noted between the low-VOC and high-VOC primers/sealers-freeze-thaw resistance and dry-to-recoat times. The freeze-thaw resistance test determines the resistance to storage in very cold temperatures and only affects water-based coatings. Nine out of the twelve low-VOC coatings passed this test. Also, ten of the twelve low-VOC coatings tested had acceptable dry-to-recoat times of 6 hours or less. (ARB, 1995; Cowen, 1999)

NTS Study

ARB staff's analysis of the National Technical Systems (NTS) data from the SCAQMD's "Phase II Assessment Study of Architectural Coatings" indicates that overall, low VOC quick-dry primers, sealers, and undercoaters exhibited similar performance to high VOC quick-dry primers, sealers, and undercoaters. This study evaluated the performance characteristics of quick-dry primers, sealers, and undercoaters for a variety of characteristics, including brushing properties, dry times, leveling, sag resistance, hiding, and film thickness. (NTS, 1999)

Issues:

1. Issue: The 1989 version of the SCM recommended that the quick-dry primer, sealer, and undercoater category be eliminated. This category was considered a popular loophole for manufacturers attempting to sidestep more aggressive controls. The ARB should re-evaluate the benefit of this category and its VOC limit in the SCM.

Response: To eliminate potential confusion, we are proposing to include the quick-dry primer, sealer, and undercoater category in the SCM. We are including this category to make it clear that the SCM is proposing a limit for quick-dry primers, sealers, and undercoaters. Please note that while a separate category is proposed for this category, the proposed limit is the same as that proposed for the primer, sealer, and undercoater category. Because these limits are the same, there would be no advantage to manufacturers to make quick-dry claims that do not apply to their primers, sealers, and undercoaters.

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19. Recycled Coatings

Product Category Description:

Recycled coatings are products made with not less than 50 percent post-consumer and secondary coating by weight, and not less than 10 percent post-consumer coating by weight. Post-consumer coating is a finished coating that has completed its usefulness to a consumer, and that would otherwise be disposed of as solid waste. Post-consumer coating does not include manufacturing waste. Secondary coating is a fragment of finished coating or finished coating that converts resources into a commodity of real economic value, not including excess virgin resources from manufacturing. These definitions are adapted from California Public Contract Code (PCC) section 12200, which describes the content of recycled products (not just coatings) purchased by the State of California.

For the purposes of the SCM, post-consumer coating is a product that was purchased by a consumer but not used up, and then recycled in another product (California Acquisition Manual, 1999). Post-consumer coating can include waste coating collected from household hazardous waste collection programs, coating returned directly to the manufacturer by the consumer, or coating donated to the manufacturer by contractors or other coating manufacturers. Secondary coating includes material that did not reach the consumer before being recycled (California Acquisition Manual, 1999). Examples of secondary coatings are coatings that do not meet manufacturers' specifications, partially manufactured coatings that were subject to a manufacturing error, or off-color coatings.

The SCAQMD, in Rule 1113, defines recycled coatings as those collected through household hazardous waste or other resource recovery programs, that contain not less than 50 percent secondary post-consumer waste coating, and not less than 10 percent post-consumer waste coating (SCAQMD, 1999). This is essentially the same definition as we are proposing.

Thus, recycled coating, as the term is used in the proposed SCM, refers to a coating that has been reprocessed to maximize its application and performance qualities. Recycled coating also includes consolidated coatings that are reprocessed (e.g., those that are collected by counties, reprocessed by a recycled coating manufacturer, and sold back to the counties), but does not include consolidated coatings that are simply combined and reused without reprocessing. This reprocessing criterion is intended to ensure the highest quality for the recycled coatings.

Recycled coatings were not included in the 1998 ARB Architectural Coatings Survey. Based on manufacturers' estimates, statewide sales of recycled coatings are at least 100,000 gallons per year, not counting unprocessed consolidated coatings. Additional coatings are reused "as is" by donation to charitable organizations. Recycled coatings are regulated currently as flats or nonflats at the prevailing VOC limit in district rules of 250 g/l.

Product Use and Marketing:

The California Integrated Waste Management Act of 1989 created a statutory goal of diverting solid waste from landfills by 50 percent by the year 2000 (Public Resources Code sections 40050-40063). The California Integrated Waste Management Board (CIWMB) oversees

this program, which requires all local governments in the State to meet this goal. Further, the Hazardous Waste Recycling Enhancement Act of 1998 requires State agencies to purchase recycled products, including coatings, whenever the recycled products are available at the same cost or a lower cost than the non-recycled products, as long as the fitness and quality are equal (PCC sections 12170, 12200, and 10233). The State agencies have minimum goals of using at least 50 percent recycled coatings in 2000 (Recycled Product Purchasing, undated).

Based on various surveys, the average household generates one to three gallons of excess coating per year, and on average, stores the coating for 4.6 years before disposing of it (Wills, 1995). There is a great deal of recyclable latex coating collected at community household hazardous waste collection sites. In the SCAQMD alone, 239,000 gallons were collected in 1996-1997, and about 275,000 gallons were collected in 1997-1998 (Baker, 1999). The statewide total of water-based latex coating collected in 1998 was about 6.5 million pounds, and is growing (Halverson, 1999). This translates to nearly 765,000 gallons statewide, based on a conversion factor of 8.5 pounds per gallon.

CIWMB reports that currently there are eight manufacturers of recycled latex coating in California, and three sources of consolidated coating. The post-consumer coating content of the recycled coatings ranges from 35 to 100 percent (CIWMB, 1999).

Recycled coatings are sold and used in many of the same ways as virgin coating. Some manufacturers sell recycled coatings through their retail stores, while others sell by special order. Some manufacturers receive coatings from counties, then reprocess the coating, and sell the product back to the counties. Recycled coating meeting the specifications for reprocessed and consolidated coating in General Services Administration (GSA) specification TT-P-2846, is also sold by the federal GSA (U.S. EPA, 1997).

Recycled coating is available in flat, semigloss, and gloss, and some manufacturers can custom-match colors. Local governments often consolidate coatings for use in graffiti abatement programs, but the coating is not processed by the manufacturer to meet performance specifications. However, Caltrans notes that municipalities expect the coating used in sound wall graffiti abatement to be color-matched (Tsztoo, 1999).

Product Formulation:

All recycled coatings currently for sale in California are water-based latex flats or nonflats.

A study for the CIWMB (Wills, 1995) showed that collected recyclable coatings are low in viscosity, density, and solids content. Most of the collected coatings contain filterable solids up to one percent, which indicates that filtration will be needed to produce a finished coating that can be sprayed.

The dry time, dry opacity, sag, lead, mercury, cadmium, and VOC content of recycled coatings are specified in the State of California bid specification (Bid Specification, 1998). The federal specification (Federal Specification, 1993) also contains requirements for freeze-thaw stability, application properties, odor, scrub resistance, total solids, fineness of dispersion, and

gloss.

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit of 250 g/l is technologically and commercially feasible by the January 1, 2003, effective date based on: discussions with current and prospective manufacturers, regulators at the State and federal levels, and end users; and an evaluation of State and federal statutes, regulations, specifications, and guideline documents.

Only one district rule has a category for recycled coatings. SCAQMD added this category in its May 14, 1999, amendments to Rule 1113, with a VOC limit of 250 g/l, effective May 14, 1999, and a 100 g/l limit in 2006.

We have included a reporting requirement in the SCM that is similar to that in SCAQMD Rule 1113. Recycled coating manufacturers must file a letter with the Executive Officer of the ARB certifying their status as a recycled coating manufacturer. They must also submit annual reports to the ARB, by April of each year, stating the total number of gallons of all recycled coatings distributed in California.

Issues:

1. Issue: ARB should look into the inability of coating manufacturers to handle recycled materials because they are non-licensed recyclers.

Response: California has no special licensing requirements to process recycled coatings. Health and Safety Code section 25217.4 states that a person may recycle recyclable latex coating at a facility that does not have a hazardous waste facility permit if the person complies with section 25217.2. This includes storing and handling the coating to minimize the chance of exposing the handler and the environment to potentially hazardous constituents, managing any non-recyclable material accepted as hazardous waste, and having emergency response plans and procedures in place.

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20. Roof Coatings

Product Category Description:

Roof coatings are non-bituminous coatings labeled as and formulated for application to exterior roofs for the primary purpose of preventing penetration of the substrate by water or reflecting heat and reflecting ultraviolet radiation. Those polymer modified roof coatings containing bitumens are included in the bituminous roof coatings category. Metallic pigmented roof coatings, which qualify as metallic pigmented coatings are included in the metallic pigmented coatings category. Roofing primers are included in the primers, sealers, and undercoaters category. (RCMA, undated)

Table D-27 below summarizes our estimate of sales and VOC emissions from the roof coatings category.

Table D-27
Roof Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Borne	70	116,174	259	0.19
Water-Borne	104	2,793,258	13	0.11
Total	174	2,899,615	23	0.30

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

Subsequent to the ARB's 1998 Architectural Coatings Survey, the Roof Coatings Manufacturer Association (RCMA) supplied us with supplemental data gathered from a survey they conducted. These data cover additional companies that did not report in the 1998 ARB survey and totaled approximately 300,000 gallons. After review of these additional data, we found that they support the findings of our ARB survey.

Product Use and Marketing:

Roof coatings are designed to be used at ambient temperatures and require little if any heating to facilitate application. Roof coatings are used primarily by professional roofers. However, these products are designed for ease of use and may be used by the homeowner. Products can be found in a variety of locations including local hardware stores. (RCMA, undated)

Product Formulation:

Typically, roof coatings are comprised of a resin (butadiene, urethane, polyvinyl acetate), a carrier solvent (water or petroleum solvent), reinforcing fillers (fibers, clays), and optional reflective pigments. Upon application, the carrier solvent evaporates from the coating leaving a

cured water-resistant film. These coatings are formulated with a variety of synthetic polymer resins, similar to latex house coatings. There are several enhanced performance characteristics of these polymeric roof coatings: low temperature flexibility, chemical resistance and elasticity. (RCMA, undated)

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit of 250 g/l is technologically and commercially feasible by the January 1, 2003, effective date based on the following factors: complying market share; data provided by the RCMA; and, meetings with members of the roofing industry.

The proposed VOC limit of 250 g/l is the same as the limit in the National Rule. While most district rules have a 300 g/l limit, the national rule sets a 250 g/l limit for this category. SCAQMD Rule 1113 also has a 250 g/l limit for this category. The complying products and market share for the ARB survey data are shown below in Table D-28. The supplemental data provided by RCMA shows a similar complying market share of 95 percent.

Reformulation efforts will continue in the replacement of solvent-borne coatings with water-based. This trend is shown in the Supplemental Roof Coatings Data table above.

Table D-28
Roof Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
250	125	97	0**

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

** The proposed limit is identical to the National Rule limit. Accordingly, no additional reductions will occur from the proposed SCM limit. However, the national limit will result in 0.01 tons per day reduction in the non-SCAQMD portion of the State.

Issues:

1. Issue: If patching materials are included in the proposal, we recommend a 400 g/l VOC limit for wet and dry patching material, and a 50 g/l limit for all other patching material. Emulsion based patching materials cannot be applied in wet conditions to immediately stop a leak, whereas the solvent-based and dry materials can.

Response: Most patching materials are regulated under the district adhesives rules. Please see discussion in bituminous roof coatings description for more information. (ARB, 1998)

2. Issue: It is important to acknowledge that roof coatings are non-bituminous.

Response: The proposed definition has been changed accordingly.

3. Issue: There is a problem with the definitions of roof and bituminous coatings. They were not adequately distinguished as they were in the National Rule. We would like to see no

lower limits for these categories than in SCAQMD.

Response: ARB staff met with many roof coating manufacturers and the RCMA to clarify the definitions for roof and bituminous coatings. Please see the product category descriptions for additional information.

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21. Rust Preventative Coatings

Product Category Description:

Rust preventative coatings are products designed for use to prevent the corrosion of metal surfaces in residential situations. The coatings in this category are limited to those used for metals, such as iron, steel, aluminum, and galvanized iron/steel. Coatings recommended for nonmetallic substrates, such as wood, masonry, plaster, drywall, or fiberglass, are excluded from this category. Residential use means use in areas where people reside or lodge including, but not limited to, single and multiple family dwellings, condominiums, mobile homes, apartment complexes, motels, and hotels.

Table D-29 below summarizes our estimate of sales and VOC emissions from the rust preventative coatings category.

Table D-29
Rust Preventative Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	PD	PD	382	0.14
Water-Based	PD	PD	144	~0.00
Total	25	63,099	371	0.14

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.
PD = Protected Data.

Product Use and Marketing:

Typical uses of rust preventative coatings include the corrosion protection of residential metal attachments and fixtures, such as handrails, fencing, doors, and gutters. This category is intended to include coatings with ease of application, which is required by the typical do-it-yourself homeowner or painting contractor (South Coast AQMD, May 14, 1999). Surface preparation may require dry and clean surfaces. Small amounts of rust that are not easily removed may be left in place for some coatings. A rust preventative coating is oftentimes a primer. Generally, common application methods, such as by brush, roller, or spray may be used.

Rust preventive coatings are available to the residential consumer and painting contractor through typical sales outlets, including paint stores, hardware stores, and mass-market general merchandise stores.

Product Formulation:

Rust preventative coatings include primers and topcoats. The traditional solvent-based alkyd formulations are generally noted for being user-friendly, easily brushed, and more tolerant of less than perfect surface preparation of metal. It may be difficult for the do-it-yourselfer to thoroughly remove rust and other contaminants from the metal, especially if sandblasting equipment is not available. The alkyd formulations will better adhere to the metal under these conditions compared with other types of formulations. Primers may contain various rust inhibitive pigments, such as silicate compounds.

An example of other formulations is water-based acrylics. Water-based formulations may be user-friendly because of less objectionable odor and easier cleanup.

Formulations in the rust preventative coatings category generally do not include the more sophisticated two-component polyurethane and two-component epoxy formulations that require special training and professional equipment (such as industrial-grade protective gear, including respirators).

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit is 400 g/l, effective January 1, 2003. The proposed limit is technologically and commercially feasible, by the effective date, based on our review of complying market share and information on current coatings (e.g. product data sheets).

As indicated in Table D-30 below, 64 percent of the market already complies with the proposed limit. Because districts have included rust preventative coatings in the "industrial maintenance coatings" category, some of the traditional alkyd coatings are now formulated to below 420 g/l, the current VOC limit for "industrial maintenance coatings" in many districts. Some of these rust preventative coatings also comply with the proposed VOC limit of 400 g/l. Non-complying coatings generally are in the range from 400 to 500 g/l. Manufacturers of non-complying coatings have the option of adjusting formulations, tightening quality control, increasing solids content, or substituting solvents with exempt compounds [e.g. Oxsol 100™ or the potential future exempt solvent tertiary-butlyl acetate (TBAc™)], to comply with the proposed limit.

Table D-30
Rust Preventative Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
400	16	63.5	0***

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

** Grams VOC per liter of coating, less water and exempt compounds.

*** The proposed limit is identical to the National Rule limit. Accordingly, no additional reductions will occur from the proposed SCM limit. However, the national limit will result in 0.01 tons per day reduction in the non-SCAQMD portion of the State.

The SCAQMD is currently the only district that has a VOC limit specific to this category. The SCAQMD limits are 400 g/l (effective May 14, 1999) and 100 g/l (effective July 1, 2006). In other districts, rust preventative coatings have been included in the "industrial maintenance coatings" category.

The proposed limit is the same as the U.S. EPA limit in the national rule and the SCAQMD limit effective on July 1, 2002.

Issues:

1. Issue: The proposed "rust preventative coating" category is needed because residential users and painting contractors need single-component rust preventative coatings that are user-friendly. These coatings are typically alkyd-based formulations at around 400 g/l. "Industrial maintenance coatings" are generally not suitable for residential users. A lower VOC content limit would create a shift in technology, such as to two-component polyurethane or two-component epoxy coatings that are too difficult for the typical homeowner to use.

Response: The ARB staff agrees and is proposing the "rust preventative coating" category with a VOC limit of 400 g/l.

2. Issue: The limit should be left at the level of the national rule limit at 400 g/l.

Response: See Response to Issue 1.

3. Issue: There is confusion concerning the use of "industrial maintenance coatings" and "rust preventative coatings" because of category overlap and inconsistencies of the definitions and labeling requirements. Also, there is confusion concerning commercial and institutional use in terms of which category applies, if any.

Response: The staff has deleted the provision that would have allowed "rust preventative coatings" that also meet the definition for "industrial maintenance coatings" to be subject only to the higher 400 g/l limit for "rust preventative coatings." This revision should more effectively separate the use of coatings in these two categories. Labeling and reporting requirements for coating manufacturers will also distinguish coatings between the categories. Industrial maintenance coatings may be used in commercial and institutional situations that are exposed to the extreme environmental conditions identified in Section 2.25 of the SCM.

4. Issue: There is overlap and confusion between the "rust preventative coating" category and the "primer, sealer, undercoater" and the "quick-dry primer, sealer, undercoater" categories.

Response: The primers in the "rust preventative coatings" category must be labeled for rust prevention of metals and are limited to residential users (including users for single and multiple family dwellings, condominiums, mobile homes, apartment complexes, motels, and hotels). Section 3.2 of the SCM has been revised to clarify that rust preventative coatings

(including primers) are not subject to the most restrictive limit (e.g. the VOC limits for primers, sealers, and undercoaters, and for quick-dry primers, sealers, and undercoaters).

5. Issue: The "rust preventative coating" category has the potential for abuse. Some coating manufacturers may relabel "industrial maintenance coatings" to be "rust preventative coatings" to take advantage of a less stringent limit and avoid reformulation.

Response: The staff has deleted the provision that would have allowed "rust preventative coatings" that also meet the definition for "industrial maintenance coatings" to be subject only to the less stringent 400 g/l limit for "rust preventative coatings." This revision should more effectively separate the use of coatings in these two categories. ARB staff will monitor the sales of "rust preventative coatings" by evaluating sales data obtained from coatings manufacturers, as required by Section 5.2 of the SCM.

REFERENCES

Air Resources Board, Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

South Coast AQMD Staff Report. Amend Rule 1113 - Architectural Coatings. May 14, 1999 Board Meeting (South Coast AQMD, May 14, 1999)

22. Specialty Primer Coatings

Product Category Description:

Specialty primer coatings are products designed for application to a substrate to block stains; to seal fire, smoke, or water damage; or to condition excessively chalky surfaces. An excessively chalky surface is one that is defined as having a chalk rating of four or less as determined by ASTM D-4214 – Photographic Reference Standard No.1 or the Federation of Societies for Coatings Technology "Pictorial Standards for Coatings Defects."

Under the proposed SCM, the labels of all specialty primers must prominently display language specifying that they are for use only to block stains, or on substrates damaged by fire, smoke, or water, or on excessively chalky substrates.

The specialty primer category was not surveyed in the Air Resources Board's 1998 Architectural Coatings Survey, but is comprised of products reported under the primer, sealer, and undercoater category, the sealer category, and the quick-dry primer, sealer, and undercoater category. The estimate of sales is based on information provided by industry and review of product data sheets making claims of efficacy when used on substrates damaged by fire, smoke, water, stains, or on substrates with excessively chalky surfaces.

The total number of specialty primer coatings is estimated to be approximately 5 percent of the aforementioned categories reported under the 1998 ARB survey, which would equate to approximately 409,000 gallons per year. The VOC content listed on the product data sheets reviewed ranged from "too low to measure" (Zehrung Z-Prime II) to 450 g/l. (Bennette Super Kill White Primer, Kilz Ultra Low Odor, Dunn-Edwards Block-It Quick Dry Primer Sealer, Zehrung Z-Prime).

Product Use and Marketing:

Specialty primers can be purchased by all consumers at outlets such as hardware stores, home supply stores, and retail paint stores, and by professionals at wholesale-only outlets.

Specialty primers are intended for use only on substrates with specific damage, as indicated by the definition, that can not be effectively sealed by general use primers, sealers and undercoaters or quick-dry primer, sealers and undercoaters. Stains resulting from extractive bleeding are difficult to block and are discussed in detail below. Other types of stains not discussed in this section may also necessitate the use of specialty primers. Conditions which may necessitate the use of specialty primers, are described below:

Excessively Chalky Surfaces

Chalking is the formation of a fine powder on the surface of a coating. It can result when the coating binder is destroyed by sun and moisture, the coating contains insufficient binder to wet the pigment, or too much thinner has been added to the coating. As the binder

disintegrates, the pigment becomes exposed on the surface as a fine powder. (McNeill) Generally, alkyd coatings chalk more quickly and to a greater degree than acrylic latex coatings.

There are various degrees of chalking. Rubbing the surface with a finger or dark cloth will indicate the severity of the chalking condition. Very light chalking, particularly on white coatings, is often desirable because the surface powder washes off with rainfall to maintain a clean surface. Medium and heavy chalking will cause a tinted coating to lose its color and become lighter. Severe chalking makes recoating a problem because the extreme porosity of the surface powder will affect adhesion and does not provide the coating a firm surface for bonding. (McNeill)

Extractive Bleeding Stains

Dry wood is composed of cellulose, lignin, hemicelluloses and minor amounts of extraneous materials, which may be either organic or inorganic. The organic components of the extraneous materials are referred to as extractives because they can be removed by extraction with solvents without altering the cellulose/lignin structure of the wood. Extractives include tannins and other poly-phenolics, coloring matter, essential oils, fats, resins, waxes, gums, and starch.

Extractives are often classified according to the type of solvent that will extract them from the wood. Solvents include water, alcohol, and ether. Once in solution, extractives typically exhibit a reddish brown color. Upon evaporation of the solvent, the colored extractives are deposited on the evaporating surface, causing discoloration. When the surface is a painted or stained wood surface, the discoloration can be a problem.

Water-soluble extractives are the extractives most commonly responsible for discoloration of coatings. Discoloration of coatings or stains may occur when extractives that are dissolved into solution by water reach the coated surface and remain as a gray to reddish-brown stain after the solvent evaporates. This is termed extractive bleeding. Water soluble extractives are found in the heartwood of most species, but high concentrations are often found in the heartwood of decay resistant species such as western red cedar and redwood.

When extractive discoloration occurs, water is typically the primary causal agent. In some species, extractives migrate to the wood surface during the drying process. If concentrations at the surface are high enough, the extractives may interfere with proper penetration, absorption and/or drying properties of the applied finish. Most extractive-related coating discoloration problems, however, are a result of moisture incurred after installation and coating.

Diffused discoloration of a coating typically results from the penetration of the coating film by liquid water or water vapor. These exterior sources of water include rain, dew, irrigation and high humidity. Diffused discoloration will usually occur in the first cycles of wetting after painting and can be attributed to a porous or thin coating which is either insufficient or inadequate to prevent water penetration.

The water present as the carrier in water-based finishes can also contribute to diffused

extractive discoloration. Usually, discoloration is evident at the time of application, before the finish dries. It is for this reason that either solvent-based oil or alkyd or stain-blocking latex primers are usually specified for wood species that are prone to extractive bleeding.

In all cases for all species of wood, the primer is the most important coat in preventing discoloration when coatings are used. Top quality stain-blocking primers prevent the extractives from being transported to the topcoat. (Donegan, et al)

Water, Smoke and Fire Damage

These stains must be properly sealed before coating or they will continue to bleed through newly applied coats of latex coatings. Water stains allow various substances, such as roofing tar and iron oxide, to bleed through and cause discoloration. (Dunn-Edwards)

Surface Preparation

Chalky surfaces require different degrees of preparation depending on the amount of chalk on the surface. Severe chalking requires pressure washing or sandblasting to remove chalked coating and provide a firm, sound surface. (Dunn-Edwards) If a pressure washer or sand blaster is not available, the surface can be washed with mild detergent and a stiff brush, and the residue removed with a stream of water from a garden hose. Proper cleaning of surfaces before applying primer is critical on smoke damaged substrates. After thorough cleaning the surface may be primed. The topcoat should be tested over a small section to assure the stain has been sealed. If the stain burns through, a second coat is typically applied and tested again before proceeding with the topcoat. (KILZ Sealer, Primer, Stain Blocker)

Please refer to the section on *Surface Preparation* in the chapter on primers, sealers, and undercoaters for additional information on general surface preparation, product application, and minimum and maximum recoat times.

Product Formulation:

This category utilizes a variety of available coating technologies in its formulations, including alkyds, modified alkyds, oleoresins, epoxies, specialty resins, and emulsions.

Coatings ingredients fall into four basic categories:

- Pigments to provide color and hide;
- Binder to hold the pigment particles together and provide adhesion;
- Liquid to act as a carrier for the pigments and binder; and
- Additives to enhance certain properties like brushing ease and mildew resistance. (PQI)

In alkyd and oil-based coatings, most of the liquid is a solvent, usually a petroleum distillate. The solvent-based coatings in this category are commonly formulated using alkyd resins as binders. Because the specialty primer category was not surveyed, our analysis of the product category was dependent mainly upon review of product data information sheets. This review indicates that the majority of the specialty primer products are alkyd-based products.

Most of the products in the specialty primer category are white. While some product data sheets reviewed indicate that the product may be tinted, others give specific recommendations against tinting. Titanium dioxide is the most widely used white pigment because of its superior hiding power.

Proposed VOC Limit and Basis for Recommendation:

The recommended VOC limit for the specialty primers category is 350 g/l, effective January 1, 2003. The proposed VOC limit is technologically and commercially feasible by the January 1, 2003, effective date based on our review of product data sheets and information provided by manufacturers. Our recommended limit is consistent with the interim limit adopted by the SCAQMD. The proposed limit is consistent with the current national limit for primers, sealers, and undercoaters. Currently, products meeting this limit can perform the functions of specialty primers, as defined above.

As previously mentioned, this category was not surveyed under the ARB's 1998 Architectural Coatings Survey, so data on number of complying products and complying market share are not available. However, a review of product data information sheets indicates a large number of products, both water-based and solvent-based, meet the proposed limit of 350 g/l.

Product data sheet review indicates there are several acrylic resin water-based specialty primers with VOC contents of less than 350 g/l which make claims of efficacy on stained substrates, including substrates with tannin staining. Product data sheet review also indicates that there are alkyd resin solvent-based specialty primer products with VOC contents of less than 350 g/l, including products that are designed specifically to bind and hold residual chalky materials to the surface. (Dunn-Edwards Surfaco Masonry Surface Conditioner)

Issues:

1. Issue: The definition for specialty primers should include products intended for application to substrates where it is necessary to block stains, odors, or efflorescence.

Response: The proposed category definition was revised to include products that block stains. Review of product data sheets indicated no specialty primers that made reference to use as an odor blocker, so inclusion of these products in the category was not deemed necessary. Product data sheet review also indicated low-VOC products are available for use on substrates with efflorescence, therefore the higher VOC content allowed for specialty primers is not necessary for substrates with efflorescence.

2. Issue: An additional category should be established for specialty primers.

Response: The specialty primer category has been established to address this concern.

3. Issue: Specialty primers are required for bonding old chalky surfaces. A category is needed for specialty primers with a VOC limit of 350 g/l.

Response: The specialty primer category, with a proposed VOC limit of 350 g/l, includes those products that are for use on excessively chalky substrates.

4. Issue: A separate category for specialty primers should be established with a VOC limit of 400 g/l. Water-based primers do not prevent water-soluble stains from bleeding through a water-based topcoat.

Response: A review of available product data sheets indicates there are water-based specialty primers below 350 g/l available that are recommended for use on water damaged substrates, and which make claims of preventing the recurrence of water soluble stains. Product data sheet review also indicates that solvent-based specialty primers are available with a VOC content of 350 g/l or less which make similar claims.

REFERENCES

Bennette Paint Manufacturing Company, Inc. Material Safety Data Sheet for "Super Kill White Primer." (Bennette Super Kill White Primer)

Donegan, Vernon, et al. Understanding Extractive Bleeding. http://www.calredwood.org/probuild/techtalk/extract/ttextrac.htm (Donegan, et al)

Dunn-Edwards Paints. Repaint and Maintenance Guide to Products and Services. 1996 (Dunn-Edwards)

Dunn-Edwards Paints. Product Information Sheet for "Block-It Quick-Dry Primer/Sealer." (Dunn-Edwards Quick-Dry Primer Sealer)

Masterchem. Internet Site. http://www.masterchem.com/ultra.html (Kilz Ultra Low Odor)
McNeill, Robert A. Course materials on surface preparation from A Condensed Comprehensive Course in Coatings Technology. October, 1992. (McNeill)

Paint Quality Institute. Training Manual "An Introduction to Paints and Coatings" (PQI)

Zehrung Corporation. Technical Data Sheet for "Z-Prime." (Zehrung Z-Prime)

Zehrung Corporation. Technical Data Sheet for "Z-Prime II." (Zehrung Z-Prime II)

23. Stains

Product Category Description:

Stains can be semi-transparent or opaque (solid) wood coating products designed and formulated to change the color of a surface but not conceal the grain pattern or texture. Semi-transparent stains will add color to the surface without concealing its natural grain pattern and texture. Opaque stains completely conceal the color variations of the grain pattern while allowing the texture of the grain pattern to be seen. This category includes lacquer stains. Many stains also protect the wood from UV exposure, provide some level of moisture repellency, and minimize tannin bleed through. (SCAQMD, 1999)

Table D-31 below summarizes our estimate of sales and VOC emissions from the stains category.

Table D-31
Stains*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	890	1,135,055	440	3.13
Water-Based	433	1,825,921	163	0.76
Total	1323	2,960,976	269	3.89

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.

Product Use and Marketing:

These types of coatings are used in cabins and homes with soft wood exterior siding, as well as on wood fences, decks and awnings. They are used to protect the wood from ultra violet (UV) exposure, moisture, and minimize tannin bleed through. The survey results indicate that 99 percent of opaque stains are recommended for exterior use only, and less than 1 percent are for interior use only. Whereas 50 percent of semitransparent stains are for exterior use, 32 percent are for interior use, and 18 percent are for interior and exterior use (ARB, 1999). Stains are sold in hardware stores, department stores, at home improvement centers, and paint stores.

Product Formulation:

Semi-transparent stains have traditionally been oil-based formulations that penetrate the wood substrate to protect against cracking, splitting, and warping of wood, and can be both interior and exterior use products. In contrast, opaque stains are primarily acrylic/latex-based formulations for exterior use, and impart color to the smooth or rough siding, wood

shingles/shakes, wood trim, and plywood. Both types of stains are now available in acrylic or oil-based formulations.

Lacquer stains are semi-transparent wood coating products formulated with cellulosic or synthetic resins to dry by evaporation without chemical reaction.

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit for stains is 250 g/l. However, low solids stains that meet the criteria of a low solids coating would be subject to the proposed 120 g/l VOC limit for low solids coatings (including water and exempt compounds). The proposed VOC limit is technologically and commercially feasible by the January 1, 2003, effective date based on our review of the literature and trade journals, complying market share, existing regulatory limits, literature searches, and information provided by manufacturers or resin suppliers.

Table D-32 below summarizes our estimates of the number of products that were marketed in 1996 that complied with the proposed VOC limit, their associated market share, and the emission reductions that would be realized if the limit were implemented in the non-SCAQMD portions of the State. As shown in Table D-31, over half of the market currently complies with the proposed VOC limit.

Table D-32
Stains*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
250	337	52.8	0.64

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Literature Searches

Several new lower-VOC interior and exterior semi-transparent stains, as well as opaque exterior stains, are available that comply with the proposed limit.

Behr Process Corp. currently markets four stain products with VOC contents of less than 250 g/l. Deck Plus® Solid Color Deck, Fence & Siding Stain is a 100% acrylic latex emulsion with 159-184 g/l VOC. Behr No. 9 Oil/Latex Redwood Stain is an oil-latex emulsion with 156 g/l VOC. Plus 10 Solid Color Oil/Latex Stain is an oil-latex emulsion with 110-116 g/l VOC. Plus 10 Semi-Transparent Oil/Latex Stain is an oil-latex emulsion with 210-225 g/l VOC. (Behr, 1999)

Vianova Resins, Inc., has utilized an alkyd/acrylic hybrid polymer known as RESYDROL® for formulating low-VOC (less than 250 g/l) semi-transparent, opaque, and interior wiping stains. The manufacturer states that exterior exposure studies, indicate that over four years of exterior exposure can be expected, without any flaking, cracking, or peeling. This polymer will form a film at or near freezing temperatures without using any co-solvents. Several formulations below the proposed 250 g/l limit are available from Vianova Resins.

(RESYDROL®, 1999; PCI, 1999)

Sherwin-Williams has several stains that have a VOC content less than 250 g/l. Okon, Performance Coatings, FSM Corporation, PPA Technologies, Rhinoguard, and Sierra Performance Coatings also have coatings containing less than 250 g/l VOC. Interior semi-transparent stains that comply with the proposed 250 g/l are available from Deft, Inc., Sierra Performance Coatings, PPA Technologies, and Führ Research Laboratories. (SCAQMD, 1999)

Blue River Coatings markets a water-based stain with 60 g/l VOC content developed to act as a stain and primary sealer. The resins in the product are designed to help the product dry quickly thus minimizing excessive grain raising, seal the wood to help repel water, and not allow the pigment to chalk off like other stains. A water-based or solvent-based sanding sealer or topcoat is recommended. This product is currently used by two major manufacturers of whirlpool hot tubs. (Blue River, 1999)

Consumer Reports magazine rated nine high-VOC solvent-based semi-transparent stains and lower-VOC water-based stains. They concluded that there were three water-based stains in the good to very good category, with four solvent-based formulations performing in the very good to excellent range. However, the water-based semi-transparent stains outperformed two solvent-based coatings. (CR, 1998)

Issues:

1. Issue: Low VOC stains have limited open time and poor lapping performance.

Response: The new alkyd/acrylic hybrid polymers, alkyd-modified acrylics, and modified acrylic/water dispersible drying oil formulations make claims of acceptable open time and lapping performance. Also, one must consider the area to be covered as well as environmental conditions when determining the appropriate application technique which should be used in order to maintain a wet edge and avoid lapping problems. In addition, the use of water-based pre-stain and wood conditioners will help minimize blotching.

2. Issue: Low VOC stains do not penetrate as well as high VOC stains.

Response: With the new alkyd/acrylic hybrid polymers, alkyd-modified acrylics, and modified acrylic/water dispersible drying oil formulations, open time is longer which also results in better penetration. Penetration has also been enhanced by advancements in pigment technology, which have substantially reduced the size of available pigments, which results in better penetration.

3. Issue: Water-based semi-transparent stains open the wood's grain and dry too fast.

Response: With the new alkyd/acrylic hybrid polymers, alkyd-modified acrylics, and modified acrylic/water dispersible drying oil formulations, there are excellent open times and minimal, if any, grain raising. In addition, the use of water-based pre-stain and wood conditioners will reduce grain raise on all bare wood surfaces.

REFERENCES

Air Resources Board. Final Report. "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

Behr Process Corp. Product Data Sheets. (Behr, 1999)

Blue River Coatings. Product Data, Wood Stain. (Blue River, 1999)

Consumer Reports. June 1998. (CR, 1998)

Paint and Coatings Industry Magazine. November 1999. pp.42-44. "Varnishes and Stains." (PCI, 1999)

SCAQMD. Draft Staff Report. "Proposed Amendments to Rule 1113 – Architectural Coatings." May 14, 1999. (SCAQMD, 1999)

Vianova Resins. Technical Update. "RESYDROL®, Acrylic-Modified Alkyd Emulsions for Wood Stains and Varnishes that Perform Better than Solvent-Borne Systems." (RESYDROL®, 1999)

24. Swimming Pool Coatings

Product Category Description:

Swimming pool coatings are coatings applied to the interior of swimming pools and are formulated to resist swimming pool chemicals. Swimming pool coatings are water-based or solvent-based coatings such as epoxies or acrylics that are applied on uncoated pool surfaces or over other similar coatings.

Table D-33 below summarizes our estimate of sales and VOC emissions from the swimming pool coatings category.

Table D-33
Swimming Pool Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	PD	PD	438	0.01
Water-Based	PD	PD	147	~0.00
Total	18	3,492	406	0.01

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.
PD = Protected Data.

Product Use and Marketing:

Swimming pool coatings are sold at pool supply stores, do-it-yourself home centers, hardware stores, and are sold directly from the manufacturer by mail order or contract. They are usually applied by the homeowner or swimming pool repair and maintenance companies. Swimming pool coatings are applied by roller or thinned and sprayed. They are high in solids, and need to be applied in a thick coating. Swimming pool primers are often used on bare surfaces, although many coatings are self-priming. Thinning of the first coat is often recommended, and more than one coat is often recommended.

Surface preparation is required for the application of any swimming pool coating, including draining the pool, washing the pool surfaces with a trisodium phosphate solution, acid etching with muriatic acid solution, washing again with trisodium phosphate solution, and thorough drying. The coating must be applied at the proper conditions including temperature, sunlight, and lack of rainfall. The pool cannot be refilled for five to seven days after coating.

Swimming pools are coated primarily for aesthetic reasons, to provide a glossy surface over rough concrete. These coatings are also used to seal the pool's rough surface, and to

prevent growth of algae or bacteria in the porous surfaces of the concrete. Coatings can be used where color is desired, or to cover discoloration. With the required surface preparation, most people recoat the whole pool, rather than simply repairing small areas.

The service life of any swimming pool coating is highly dependent on the surface preparation, weather conditions during coating, how long the homeowner waits before refilling the pool, and the care the homeowner takes in maintaining proper water balance and performing other routine maintenance.

Product Formulation:

Chlorinated rubber-based pool coatings were used exclusively on swimming pools prior to the development of epoxy coatings. Much of the demand for rubber or synthetic rubber coatings can be attributed to the fact that rubber-based coatings are needed for compatibility with the old coating. Chlorinated or synthetic rubber coatings last one to five years with residential use, depending on the grade and the amount of rubber in the coating.

Epoxies are a fast-growing product as a replacement for chlorinated rubber-based coatings because of their durability. Depending on the manufacturer and the grade of product, epoxies may give four to ten years of service life, two or three times that of chlorinated rubber-based coatings. All epoxies are subject to surface chalking on exposure to ultraviolet light, but this is surface chalking that can easily be cleaned off. Severe rub-off chalking indicates another problem such as water imbalance or refilling the pool too soon. Most epoxies are two-part solvent-based products, although there are water-based epoxies. Manufacturers we interviewed generally are satisfied with the performance of their epoxy coatings.

Acrylic swimming pool coatings are water-based, can be applied on damp surfaces and cure within three days. They can be applied over chlorinated rubber or properly prepared epoxy coatings.

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit of 340 g/l is technologically and commercially feasible by the January 1, 2003, effective date based on: complying market share; a review of product literature on coatings included in this category; and discussions with manufacturers and retailers of these coatings.

The complying products are either two-part epoxy or single-component acrylic. Epoxies can be either solvent-based or water-based.

All districts except San Diego County and Mojave Desert (both with a VOC limit of 650 g/l) currently have a 340 g/l VOC limit, although the category is exempt in the Bay Area, Butte County, Colusa County, Feather River, and Monterey Districts. The swimming pool coating category was created in the 1989 SCM with a VOC content limit of 340 g/l, effective in 1992 (TRG/ARB, 1989).

Several manufacturers make solvent-based epoxies with VOC content ranging from

340 g/l to 425 g/l. The water-based epoxies range from 230 g/l to 250 g/l. The VOC content of acrylic coatings range from 200 g/l to 230 g/l. The primers are either solvent-based or water-based and range from 70 g/l to 420 g/l.

The 1998 ARB Architectural Coatings Survey shows that 43 percent of the swimming pool coatings already comply with the proposed 340 g/l limit. Reformulation of existing non-complying coatings will likely focus on the water-based epoxies and acrylics, and further reducing the VOC content of the solvent-based primers and epoxy coatings. We would expect that as more solvents are exempted from VOC status by the U.S. EPA and districts, manufacturers will try to reformulate chlorinated rubber coatings with these solvents.

Although Table D-34 shows that the VOC emission reductions in the non-SCAQMD portion of California would be very low from implementing the proposed limit of 340 g/l, we note that there could be minor emission reductions if districts without a VOC limit for swimming pool coatings adopt the proposed limit.

Table D-34
Swimming Pool Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
340	PD	PD	0

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

** Grams VOC per liter of coating, less water and exempt compounds.

PD = Protected Data.

Issues:

1. Issue: The specified VOC limit for swimming pool repair and maintenance coatings of 650 g/l in Table 1 is higher than the 600 g/l limit these coatings must meet under U. S. EPA's National AIM Rule. The SCM should recommend a VOC limit that is consistent or more stringent than the 600 g/l limit specified in the U.S. EPA's rule.

Response: The commenter is referring to an earlier version of the proposed SCM in which a VOC limit of 650 g/l was proposed for swimming pool repair and maintenance coatings. We are now proposing a more stringent 340 g/l VOC limit.

2. Issue: The proposed SCM contains proposed VOC limits for swimming pool repair coatings at 650 g/l. This is a relaxation of the 1989 SCM and Ventura County APCD Rule 74.2. We recently initiated enforcement action on the sale of coatings exceeding this standard.

Response: The commenter is referred to the response to issue number 1.

3. Issue: If you have to repair a chlorinated rubber coating, the repair coating has to be chlorinated rubber. At 340 g/l, it's not going to be chlorinated rubber; it's a different technology. Epoxy-based swimming pool coatings have to be replaced more often because they fail more frequently than chlorinated rubber-based coatings.

Response: Chlorinated rubber coatings must be repaired with either chlorinated rubber coatings or acrylic coatings. We disagree that epoxy-based swimming pool coatings don't last as long as chlorinated rubber coatings. According to manufacturers who make both epoxy and chlorinated rubber coatings, the epoxies last more than twice as long as rubber-based coatings.

4. Issue: Epoxy coatings are not necessarily better, and they fail for a lot of reasons. I don't think we should assume that if it says epoxy or urethane that those are superior in the configurations that are currently sold.

Response: Both epoxies and chlorinated rubber coatings will fail if the surface is not properly prepared. Overall, epoxies are expected to outlast rubber-based coatings.

5. Issue: Are there two categories under swimming pool, swimming pool and swimming pool repair? We need to make that clearer.

Response: To avoid confusion with existing district rules, we have created two categories of swimming pool coatings in the proposed SCM, swimming pool coatings and swimming pool repair and maintenance coatings, both at 340 g/l.

REFERENCES

Air Resources Board. Final Report. "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

Technical Review Group and Air Resources Board (TRG/ARB). "ARB-CAPCOA SCM for Architectural Coatings, Technical Support Document." July 1989. (TRG/ARB, 1989)

25. Swimming Pool Repair and Maintenance Coatings

Product Category Description:

Swimming pool repair and maintenance coatings are rubber-based coatings used for the repair and maintenance of existing rubber-based swimming pool coatings (i.e., chlorinated rubber or synthetic rubber).

Table D-35 below summarizes our estimate of sales and VOC emissions from the swimming pool repair and maintenance coatings category.

Table D-35
Swimming Pool Repair and Maintenance Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	6	12,774	569	0.05
Water-Based	0	0	N/A	0.00
Total	6	12,774	569	0.05

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

Product Use and Marketing:

The swimming pool repair and maintenance coatings consist solely of chlorinated rubber or synthetic rubber coatings. Please see additional discussion under swimming pool coatings.

Product Formulation:

Swimming pool repair and maintenance coatings are formulated with either chlorinated rubber or synthetic rubber ingredients that are only soluble in solvents. Some examples of solvents used in these coatings are mineral spirits, ethylbenzene, and xylene. These coatings are high in solids and are applied in a thick layer. The percentage of the rubber ingredient used in the formulation influences the cost and service life of the coating.

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit of 340 g/l is technologically and commercially feasible by the January 1, 2003, effective date based on the successful replacement products discussed under the general swimming pool coating category.

Compliant epoxy coatings are a viable reformulation option for coatings applied to new surfaces. Also, compliant water-based acrylics can be used to repair existing rubber-based coatings.

Table D-36 shows that currently there is no complying market share. The reason is that this category is comprised of chlorinated rubber coatings that cannot currently be formulated to meet the proposed VOC limit. However, there are two complying technologies (as discussed above) in the general swimming pool coating category that are an acceptable alternative for chlorinated rubber coatings. Further, there is a three-year sell-through period in most district rules, allowing for retail sale of chlorinated rubber coatings to continue until 2006. We believe this is sufficient time for manufacturers to reformulate their existing coatings to comply with the proposed limit. Also, manufacturers may be able to reformulate rubber-based coatings using exempt solvents.

The table below also shows that VOC emission reductions in the non-SCAQMD portion of California would be 0.03 tons per day, on an annual average basis, from implementing the proposed limit of 340 g/l.

Table D-36
Swimming Pool Coatings - Repair and Maintenance Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
340	0	0.00	0.03

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
** Grams VOC per liter of coating, less water and exempt compounds.

Issues:

1. Issue: Please refer to the swimming pool coatings category.

REFERENCES

Air Resources Board. Final Report. "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

26. Temperature-Indicator Safety Coatings

Product Category Description:

Temperature-indicator safety coatings are high performance products formulated, recommended, and designed for use on the surface of equipment and piping for temperature monitoring and safety purposes. At predetermined temperature levels and exposure durations, the coating progressively changes color to indicate how dangerous the overheating problem is underneath the coating. These coatings are used on the surface of materials exposed continuously or intermittently to temperatures above 204°C (400°F), as in the related "high-temperature coatings" category. "Temperature-indicator safety coatings" is a new category, separated from the "high-temperature coatings" category, to allow for coatings needed for safety purposes.

Temperature-indicator safety coatings were not reported separately in the ARB's 1998 Architectural Coatings Survey, but were included in the "high-temperature coatings" category. Available information on sales volume from one manufacturer indicates that VOC emissions from temperature-indicator safety coatings contribute less than 0.01 tons per day statewide, excluding the SCAQMD.

Product Use and Marketing:

Temperature-indicator safety coatings are used to monitor and protect equipment and piping at oil refineries, power plants, chemical plants, industrial boiler units, heat treating plants, and similar facilities. For example, if there is breakdown of thermal insulation, the temperature-indicator safety coating covering the exterior of the equipment or piping would mark the location and indicate the severity of dangerous "hot spots" by the extent of the color change. This color change is irreversible, so after the equipment, piping, or insulation is repaired, the surface generally needs to be cleaned, prepared, and recoated.

Surface preparation and coating application methods are similar to those for the more typical "industrial maintenance coatings" (see Section D-A-12). Manufacturer recommendations may include surface preparation by abrasive blasting, wire brushing, or sanding. A primer coat may also be recommended. Application may be by conventional spray, airless spray, brush, or roller.

Product marketing is similar to marketing for the more typical "industrial maintenance coatings" (see Section D-A-12), however, temperature-indicator safety coating products are not commonly used, and hence market availability is expected to be limited.

Product Formulation:

Temperature-indicator safety coatings may be formulated with solvent-based, heat-resistant silicone-alkyd or silicone resins. Organic pigments in the coatings chemically change to different colors, progressively, at certain higher temperatures and temperature durations.

Coatings are formulated for different initial indicator temperatures, such as starting at 350°F or at 500°F.

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit is 550 g/l, effective January 1, 2003. The proposed limit is technologically and commercially feasible, by the effective date, based on our review of currently available coatings and discussion with industry representatives. The proposed VOC limit serves as a VOC content "cap" for coatings in this category.

The limit is proposed because certain equipment at oil refineries need specific temperature-indicator safety coatings for safety purposes (Chevron, 1999). These coatings do not comply with the VOC limit of 420 g/l in the "high-temperature coatings" category (see Section D-A-11). The current temperature-indicator safety coatings are generally in the VOC range of 450 g/l to 550 g/l. Based on available information, the volume of coatings used is low. For example, information from a few of the larger oil refineries in California indicates that a refinery typically uses approximately ten gallons of coating over a two to three year period.

Most district rules have a VOC limit of 420 g/l for high-temperature coatings, which currently covers temperature-indicator safety coatings in those districts. The SCAQMD has an interim limit of 550 g/l for high-temperature coatings, which covers temperature-indicator safety coatings in that district. The SCAQMD provided this interim limit, from July 1, 2002 to July 1, 2006, so that users of the temperature-indicator safety coatings would have sufficient time to comply with the district's final limit of 420 g/l, effective July 1, 2006.

The U.S. EPA limit for high-temperature coatings is 650 g/l, which covers temperature-indicator safety coatings.

REFERENCE

Chevron Products Company. Letter dated September 8, 1999 from Gail Ito, Chevron Products Company, to Jim Nyarady, ARB, regarding "Written Comments for ARB's SCM for Architectural Coatings". (Chevron, 1999)

27. Traffic Marking Coatings

Product Category Description:

Traffic marking coatings are used to provide visible markings on streets, highways, curbs, berms, driveways, parking lots, sidewalks, and airport runways. Traffic stripes or lines are longitudinal centerlines or lane lines that separate traffic lanes, and longitudinal lines on the edges of the roadways. Pavement markings are transverse markings such as word and symbol markings, limit lines indicating stop lines, crosswalk lines, shoulder markings, parking stall markings, and railroad grade crossing markings (Caltrans, 1999). The most common colors are white, yellow, black, and blue.

Table D-37 below summarizes our estimate of sales and VOC emissions from the traffic marking coatings category.

Table D-37
Traffic Marking Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons per day)
Solvent-Based***	46	885,126	290	1.09
Water-Based	115	1,998,244	124	0.93
Total	161	2,883,370	154	2.02

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

*** Includes 100 percent solid coatings.

Product Use and Marketing:

Traffic marking coatings are sold in hardware stores and do-it-yourself centers. They are also purchased by contract by governments, contractors who apply coatings throughout for governments, and private businesses (NPCA, 1997). Typical users include state and local highway maintenance crews, striping contractors, municipalities, shopping center management, airport contractors, and plant maintenance personnel.

Product Formulation:

Traffic coatings are formulated to adhere to asphalt, concrete, or bricks. The most important requirements of traffic coatings are that they withstand wear from vehicular traffic and from weather, are fast drying, and are highly visible both in daylight and at night. Airport runway coatings must meet government specifications, and are highly reflective, long lasting, and durable enough to withstand jet exhaust, high-speed aircraft, and heavy loads (NPCA, 1997).

There are three general types of traffic coatings: liquids, thermoplastics, and tapes. Glass beads are added into liquid coatings immediately after application (glass beads are included in the manufacture of thermoplastic coatings and tapes). Without these round beads, which reflect light back to the source, traffic marking coatings would not be visible at night. A pressurized spray nozzle embeds about 70 percent of the beads into the coating so that as the coatings wear, new embedded beads come to the surface (Hacker, 1995).

Solvent-based coatings have been used for traffic marking for decades, and consist of alkyd or chlorinated rubber coatings. They dry as the solvent evaporates and the resins oxidize. To speed up drying, they are usually sprayed hot and under pressure using conventional spray equipment. Solvent-based coatings are low in cost and can be applied in a variety of weather conditions, but they need to be frequently applied in high-traffic areas (Hacker, 1995). These coatings have a solids content ranging from 45 percent to 55 percent, typically with a wet film thickness of 15 mils and a dry film thickness of seven to eight mils (SCAQMD, 1996).

Water-based coatings are latex emulsions that contain pigments, additives, and usually organic co-solvent, and consist of approximately 50 percent solids by volume. Water-based traffic marking coatings are typically more durable and therefore more cost-effective than solvent-based coatings (SCAQMD, 1996).

Two-component traffic marking systems include polyester, urethanes, and epoxy coatings. These coatings are used in high-traffic areas where traffic disruption and application crew safety are of concern, or in inaccessible locations. Thermoplastic traffic marking coatings are made from resins, plasticizers, pigments, and glass beads. These are heat-applied coatings that are melted at 400^{o}F and extruded or sprayed using special equipment that mixes the coating during heating to prevent burning. The coatings are typically 30-125 mils thick, which provides a long lasting coating. Because of the heating required, this technology is not available during winter in cold climate areas (Hacker, 1995; NPCA, 1997). Some solvent-based traffic coatings have been reformulated using acetone to comply with the traffic coating VOC limit in the SCAQMD rule and the National Rule.

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit of 150 g/l is technologically and commercially feasible by the January 1, 2003, effective date based on: complying market share; the technology assessments performed by the ARB, the SCAQMD in 1996, and the U.S. EPA prior to the completion of the National Rule (U. S. EPA, 1998); a review of product literature; and discussions with one of the largest users of traffic coatings in California.

The 1998 ARB Architectural Coatings Survey included data for traffic coatings submitted by 22 manufacturers covering 161 different products, which included water-based, solvent-based, two-component epoxies, and 100 percent solid formulations. The survey indicated that 69 percent of the total 1996 sales were water-based formulations, with a sales-weighted average VOC content of 124 g/l. The average VOC content of the solvent-based formulations was 290 g/l .

The SCAQMD (1996) performed a technology assessment of traffic marking coatings in developing its 1996 amendments to Rule 1113. The 1998 ARB survey and the SCAQMD staff survey indicate that compliant traffic coatings are commercially available and are being used by local governments, Caltrans, and professional contractors. Manufacturers of traffic coatings indicate development and commercial introduction of acetone-based, solvent-based formulations is under way, to add to the water-based and 100 percent solids coatings already being used.

Caltrans is a large user of traffic marking coatings. All coatings used by Caltrans are water-based or thermoplastic, except for those used in extreme northwest California, where damp, cool weather conditions require solvent-based coatings. However, to comply with the National Rule limit of 150 g/l that is in effect statewide, these solvent-based coatings are being replaced by acetone-based coatings. The thermoplastic coatings used by Caltrans are 100 percent solids, and are used on new pavement. Caltrans specifications require that water-based traffic coatings dry thoroughly within 20 minutes of application, while thermoplastics must be tack-free within 2-10 minutes, depending on the pavement surface temperature. The maximum VOC content of Caltrans' water-based coatings is 150 g/l (Gipson, 1999; Caltrans, 1999).

Reformulation to achieve compliance with this limit has largely already been accomplished, as described above. Users will be switching to water-based, thermoplastic, acetone-based, or two-component coatings throughout California, not only in districts with architectural coating rules, but also in other areas now subject to the National Rule limit of 150 g/l.

As shown in Table D-38, over 53 percent of the market complied with the proposed VOC limit in 1996.

Table D-38
Traffic Marking Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons per day)
150	107	53.40	0.00***

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

** Grams VOC per liter of coating, less water and exempt compounds.

*** The proposed limit is identical to the National Rule limit. Accordingly, no additional reductions will occur from the proposed SCM limit. However, the national limit will result in 0.36 tons per day reduction in the non-SCAQMD portion of the State.

REFERENCES

Air Resources Board. Final Report. "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

Gipson, Mitch. Caltrans. Personal communication with ARB staff. December 13, 1999. (Gipson, 1999)

State of California Department of Transportation (Caltrans). Standard Specifications,

July 1999. http://www.dot.ca.gov/hq/esc/oe/specifications/std_specs. (Caltrans, 1999)

Hacker, L. Traffic Marking Materials, in *Paint and Coating Testing Manual*, 14th edition. J.V. Koleske, ed. ASTM Manual MNL17. 1995. (Hacker, 1995)

National Paint and Coatings Association (NPCA). *Paint and Coatings "2000": Review and Forecast*, 2nd edition. 1997. (NPCA, 1997)

SCAQMD. "Draft Staff Report for Proposed Amendments to Rule 1113 – Architectural Coatings." September 26, 1996. (SCAQMD, 1996)

U. S. EPA. "National Volatile Organic Compound Emission Standards for Architectural Coatings - Background for Promulgated Standards." EPA-453/R-98-0006b. (U.S. EPA, 1998)

28. Waterproofing Sealers

Product Category Description:

Waterproofing sealers are products designed and recommended for application to a porous substrate for the primary purpose of preventing the penetration of water. They are clear or pigmented, film forming or non-film forming, compounds that are formulated to protect concrete, masonry, wood, and other porous surfaces from moisture damage. Penetration of moisture can cause staining, efflorescence, spalling, dusting, and weathering on concrete. On wood, use of waterproofing sealers can prevent splitting, staining, and warping, as well as maintain the wood's true color and grain. (SCAQMD, 1999)

Table D-39 below summarizes our estimate of sales and VOC emissions from the waterproofing sealers coatings category.

Table D-39
Waterproofing Sealers Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	161	616,356	358	1.38
Water-Based	114	453,650	307	0.17
Total	175	1,070,006	336	1.55

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.

Product Use and Marketing:

Typical uses include a variety of commercial, industrial, and residential applications. Masonry building surfaces, sidewalks, driveways, block walls, brick patios, and wood fences, decks and awnings are a few of the many surfaces that may benefit from the use of a waterproofing sealer. Waterproofing sealers are sold in hardware stores, department stores, home improvement centers, and paint stores.

Product Formulation:

These coatings rely on a variety of resin technologies, with recent developments in acrylic emulsion formulations and acetone-based formulations. (SCAQMD, 1999) Conventional alkyd coating formulations do not lend themselves to concrete/masonry applications due to their inherent incompatibility with the prevailing alkalinity of the substrate. Clear and opaque sealers are combined in this category since many opaque sealers penetrate the substrate and perform the same function as clear sealers.

There are two basic types of waterproofing sealers, continuous (film-forming) and discontinuous (non-film-forming). Continuous sealers protect by forming a film barrier to prevent water intrusion. Many conventional coating formulations are capable of providing this type of protection while possessing additional performance attributes. Continuous sealers, by nature, are typically not vapor permeable.

There are also two basic types of discontinuous waterproofing sealers, nonsilicone impregnating sealers and silicone-based sealers. Typical nonsilicone impregnating sealers are wax, silicate and stearate technology based. These technologies repel water by physically filling the pores of the substrate, and are also, by nature, typically not vapor permeable.

Silicone-based waterproofing sealers, remain permeable to water vapor. There are many types of silicone-based sealers including siliconates, linear silicones, silanes and siloxanes. Silanes and siloxanes are known for their excellent penetrating and abrasion resistance qualities.

Generally, organic based products will block water vapor but degrade when exposed to UV light, and silicone products provide excellent UV stability but are vapor permeable. Therefore, both the type of substrate and the desired performance characteristics are critical parameters in choosing the appropriate waterproofing sealer for any specific application.

Proposed VOC Limit and Basis for Recommendation:

The proposed VOC limit for waterproofing coatings is 250 g/l, effective January 1, 2003. The proposed VOC limit is technologically and commercially feasible by the January 1, 2003, effective date based on our review of the literature and trade journals, complying market share, and information provided by manufacturers or resin suppliers.

Table D-40 below summarizes our estimates for this category of the number of products that comply with the proposed VOC limit, their associated market share, and the emission reductions that would be realized if the limit were implemented in the non-SCAQMD portions of the State. It should also be noted that, because SCAQMD Rule 1113 currently has a VOC limit of 400 g/l for concrete waterproofing sealers, we would estimate that additional reductions in the SCAQMD from this limit would be about 0.14 tons per day.

Table D-40
Waterproofing Sealers*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
250	95	13	0.56

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

** Grams VOC per liter of coating, less water and exempt compounds.

The National Rule limit for waterproofing sealers is 600 g/l. Like the new National Rule, no existing district rule within California differentiates between substrates (wood vs. concrete). (U.S. EPA, 1998)

The recently amended SCAQMD Rule 1113 established separate categories and limits for wood (250 g/l) and concrete/masonry (400 g/l) waterproofing sealers that go into effect in 2002. The definition of the new cement/masonry category is "a clear or pigmented film forming coating that is formulated for sealing concrete and masonry to provide resistance against water, alkalis, acids, ultraviolet light, and staining." (SCAQMD, 1999)

Literature Searches

Staff has conducted extensive searches for waterproofing sealers that meet the proposed VOC limit of 250 g/l and found numerous manufacturers that have commercialized products available.

Behr Process Corp. currently markets two products with VOC contents below the proposed limit. Behr No. 2-85 Low Voc Multi-Surface Waterproofing Sealer is a transparent acrylic latex formulation with 211 g/l VOC. Plus 10 Elastomeric Waterproofing Paint is a 100 percent acrylic elastic latex formulation with 81 g/l VOC. (Behr, 1999)

DOW Corning Corporation has developed a new, patented, water-based water repellent technology whose components include silicone-based materials, an organic resin and an organic wax. They claim the resultant product protects wood longer, and promotes beading better than other commercially available solvent and water-based products. The VOC content is below 100 g/l. (MPC, 1998)

Gloucester Co., Inc. markets a product called PHENOSEAL® Liquid Waterproofing (PLW) with a VOC content of 97 g/l. PLW is a clear penetrating sealer made from an acrylic copolymer, in formulation with other proprietary components, intended for use on wood, masonry, concrete, and other porous building materials. It helps prevent moisture damage by penetrating and sealing the subsurface pores in the treated material. PLW generally allows transmission of water vapor through a sealed surface. PLW-treated surfaces may be coated with oil or water-based coatings after the cure is complete. (PHENOSEAL®, 1999)

Hydrozo, Inc. markets a product called ENVIROSEAL™ Double 7, a high performance, clear, penetrating water repellent sealer designed to provide long-term protection for vertical masonry and concrete block wall surfaces. It is an aqueous blend of silane and organic and inorganic oligomers with a VOC content of less than 175 g/l. (ENVIROSEAL™, 1999)

Seal Krete, Inc. has a product called Seal Krete® Waterproofing Sealer which is a water-based, acrylic sealer with a VOC content of less than 8 g/l. It is recommended for both concrete and wood. (Seal Krete®, 1999)

Sherwin-Williams makes the Cuprinol Clear Deck and Wood Seal with a VOC content of only 27 g/l. This alkyd, water-based sealer is designed for use on wood siding, fences, decks, and outdoor furniture. (SCAQMD, 1999)

Zehrung Corp. makes Zerepel WB for Masonry, a clear, penetrating water sealer for above grade masonry surfaces with a VOC content of less than 250 g/l. A water resistant barrier is formed by the chemical reaction between Zerepel WB and the masonry substrate. The

formulation penetrates beneath the surface and will not leave a film to yellow, crack, or peel. It is coatable and promotes adhesion when used as a sealer. (Zerepel, 1999)

Other manufacturers of waterproofing sealers that comply with the proposed limit include H&C, Flood Company, Okon, and Conspec. The VOC content of these coatings range from 27 g/l to 250 g/l. (SCAQMD, 1999)

Harlan Study

In 1995, Harlan Associates, under contract with the ARB, performed testing on waterproofing sealers for wood and concrete substrates. (ARB, 1995)

Waterproofing Sealers (Wood). Three of the products tested comply with proposed VOC limit of 250 g/l. Two of these sealers were solvent-based, while the remaining five were water-based coatings. The results of the tests on waterproofing sealers for wood indicated equivalent or superior performance by the complying sealers relative to the non-complying sealer for application, appearance, accelerated weathering and water repellency.

Four of the five water-based sealers tested are considered to be low-solids coatings with less than 120 g/l VOC. The VOC limits in the proposed SCM for low-solids coatings are calculated on an actual basis rather than using the traditional less water, less exempt compound basis. This low-solids calculation has been accepted by the U.S. EPA. The actual VOC for these coatings is much lower than the VOC content, less water. For example, one coating has a VOC content, less water, of 343 g/l, while the actual VOC is only 77 g/l.

The initial appearance and appearance after 300 hours of accelerated weathering of the coated wood show similar performance by the water-based and solvent-based sealers. The initial appearance was superior in two of the water-based samples; these were the only two coatings that showed no change in color of the surface. The accelerated weathering was equivalent for most of the samples.

The initial water repellency of all of the coatings was excellent, except for one of the water-based sealers that had good water repellency. The water repellency of the coatings after 300 hours of accelerated weathering was good for all coatings tested except the non-complying sealer and one of the water-based sealers that had fair water repellency. (Cowen, 1999)

Waterproofing Sealers (Concrete). Five of the eight coatings tested complied with the proposed 250 g/l VOC limit. One of these sealers was solvent-based, while the remaining seven were water-based coatings. The results of the tests on waterproofing sealers for concrete indicated equivalent or superior performance by all of the complying sealers relative to the non-complying sealers for application, appearance, accelerated weathering and water repellency. Two of the complying sealers displayed equivalent water adsorption performance relative to the non-complying sealers. Five of the seven water-based sealers are considered to be low-solids coatings with less than 120 g/l VOC, calculated as the actual VOC content.

The initial appearance and appearance after 300 hours of accelerated weathering of the coated wood showed similar performance by both the water-based and solvent-based sealers.

The initial appearance and appearance after 300 hours of accelerated weathering of all the sealers showed no change in the color of the concrete. (Cowen, 1999)

NTS Study

National Technical Systems (NTS), under contract with the SCAQMD, tested six wood waterproofing sealers and four concrete waterproofing sealers. Seven of the ten coatings tested were compliant with the 250 g/l proposed limit. ARB staff analysis concludes that, overall, the low-VOC coatings exhibited similar or superior performance compared to the higher-VOC coatings in the tests performed, which included freeze/thaw stability, water penetration, and water repellency. (NTS, 1999)

Issues:

1. Issue: Industry has indicated that low VOC coatings do not perform well on concrete/masonry surfaces, especially concrete tilt-up buildings. The SCAQMD has created a new category for waterproofing concrete/masonry sealers with a 400 g/l limit.

Response: Staff's investigation of this issue included a review of SCAQMD's records related to Rule 1113, and review of comments the ARB has received on this category. No detailed technical information was provided to support the claim that high VOC coatings are necessary to penetrate the form oils and release agent materials that are used in the forming of concrete.

REFERENCES

Air Resources Board, Final Report, Contract No. 92-339, "Testing of Architectural and Industrial Maintenance Coatings." Harlan and Associates, Inc. February, 1995. (ARB, 1995)

Air Resources Board, Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

Behr Process Corp., Product Data Sheets. (Behr, 1999)

Cowen, Stan, Ventura County Air Pollution Control District, Communication with ARB Staff, October, 1999. (Cowen, 1999)

Gloucester Co., Inc., Product Data Sheets. (PHENOSEAL®, 1999)

Hydrozo, Inc., Product Data Sheets. (ENVIROSEAL™, 1999)

Modern Paint and Coatings, Nov. 1998. (MPC, 1998)

National Technical Systems, “Phase II Assessment Study of Architectural Coatings,” under contract with the SCAQMD, data available as of June 1999. (NTS, 1999)

Seal Krete, Inc., Product Data Sheets. (Seal Krete®, 1999)

SCAQMD, Draft Staff Report, “Proposed Amendments to Rule 1113 – Architectural Coatings” May 14, 1999. (SCAQMD, 1999)

United States Environmental Protection Agency, “Final Rule: National Volatile Organic Compound Emission Standards for Architectural Coatings,” 40 CFR part 59, subpart D, 63 FR 48848, September 11, 1998. (U.S. EPA, 1998)

Zehrung Corp., Product Data Sheets. (Zerepel, 1999)

B. COATING CATEGORIES FOR WHICH THE PROPOSED VOC LIMITS ARE GENERALLY CONSISTENT WITH DISTRICT RULES

We are proposing VOC limits for the following 16 coating categories that are generally consistent with the VOC limits in California's district architectural coatings rules, including the SCAQMD's Rule 1113. The discussions for each of these coating categories includes: 1) product category description; 2) discussion of the proposed volatile organic compound (VOC) limit, and our rationale for the proposed limit; and 3) if applicable, a discussion of the issues associated with the proposed VOC limit, as raised by industry. The product categories are listed in alphabetical order.

1. Bond Breakers

Product Category Description:

Bond breakers are coatings that are applied between layers of concrete to prevent bonding of the first layer to the second layer. Coatings in this category are similar to form release compounds, except that form release compounds prevent bonding of the concrete to a non-concrete form (TRG/ARB, 1989). The first coat of a bond breaker also helps cure the concrete (U.S. EPA, 1998).

Table D-41 below summarizes our estimate of the sales and VOC emissions from the bond breakers category.

Table D-41
Bond Breakers*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	PD	PD	750	~0.00
Water-Based	PD	PD	345	0.02
Total	PD	PD	345	0.02

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.
PD = Protected Data.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 350 g/l VOC limit for bond breakers effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the high complying market share; the limit in current district rules; and the fact that most district architectural coating rules have had the same limit for several years. We also note that no adverse comments were received about the proposed limit.

Districts that regulate bond breakers (all districts except the Bay Area, Butte, Colusa, Feather River, and Monterey districts where the category is exempt) have a VOC limit of 350 g/l. Based on the recommendation of the 1989 SCM, the VOC limit for bond breakers of 350 g/l went into effect in district rules in September 1990 (TRG/ARB, 1989).

The U.S. EPA's National Architectural Coatings Rule limit of 600 g/l. However, this limit is found in the upper range of VOC content limits in existing state rules (none of the rules has a limit higher than 600 g/l) (U.S. EPA, 1998). We recommend that the VOC limit for bond breakers remain at 350 g/l at this time, which is consistent with current district rules.

Table D-42
Bond Breakers*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
350	PD	PD	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
PD =Protected Data.

Issues:

1. Issue: No comments were received on bond breakers, and we know of no unresolved issues with this category.

REFERENCES

Air Resources Board, Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

Technical Review Group and Air Resources Board (TRG/ARB). "ARB-CAPCOA SCM for Architectural Coatings, Technical Support Document." July 1989. (TRG/ARB, 1989)

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards." EPA-453/R-98-006b. August 1998. (U.S. EPA, 1998)

2. Concrete Curing Compounds

Product Category Description:

Concrete curing compounds are coatings that are applied to fresh concrete to retard moisture evaporation. These coatings are used in road construction to provide moisture retention during curing, to help with design strength and other properties. Concrete curing compounds are designed to meet a number of ASTM specifications, including ASTM C-309, Type 1, 1D, and 2; Class A (U.S. EPA, 1998).

The U.S. EPA determined that concrete curing compounds, as well as other concrete curing products, may be underrepresented in the national Architectural Coatings Survey. One commenter explained that this is because concrete curing products are made by the construction industry, not coating manufacturers (U.S. EPA, 1998). They may also be underrepresented in the ARB's 1998 Architectural Coatings Survey for the same reason.

Table D-43 below summarizes our estimate of the sales and VOC emissions from the concrete curing compounds category.

Table D-43
Concrete Curing Compounds*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	10	11,820	677	0.05
Water-Based	37	399,298	180	0.19
Total	47	411,118	195	0.24

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 350 g/l VOC limit for concrete curing compounds effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the high complying market share; the limit in current district rules and the National Rule; and the fact that most district architectural coating rules have had the same limit for several years. We also note that no adverse comments were received about the proposed limit.

All district rules except one have a VOC limit of 350 g/l for concrete curing compounds (Butte County has a VOC limit of 800 g/l). In addition to the California districts, Arizona, Massachusetts, New Jersey, and New York have a 350 g/l limit (U.S. EPA, 1998).

The U.S. EPA's National Architectural Coatings Rule also has a VOC limit of 350 g/l. All but one commenter argued that the limit is achievable (U.S. EPA, 1998).

We recommend that the VOC limit remain at 350 g/l at this time, the same as in current district rules, state rules, and the National Rule. The survey shows that there is about 95 percent compliance at 350 g/l, and this category is already heavily dominated by water-based formulations.

Table D-44
Concrete Curing Compounds*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons per day)
350	36	95.10	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Issues:

1. Issue: No comments were received on concrete curing compounds, and we are unaware of any unresolved issues.

REFERENCES

Air Resources Board. Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards." EPA-453/R-98-006b. August 1998. (U.S. EPA, 1998)

3. Dry Fog Coatings

Product Category Description:

Dry fog coatings, also called dry fall coatings or mill white coatings, are formulated so that when sprayed onto a substrate, the overspray droplets dry before they contact the floor or other surfaces. The coatings are designed to dry after falling 8 to 10 feet, depending on the formulation and the weather conditions. The use of dry fog coatings minimizes the amount of masking and covering of surfaces that are not to be coated, and the dried coating can simply be swept up for easy cleanup. The definition clarifies that these coatings are to be applied by spraying, not by brush or roller, since the quick-drying characteristics of dry fog coatings would not be necessary with non-spray application techniques (TRG/ARB, 1989).

Table D-45 below summarizes our estimate of the sales and VOC emissions from the dry fog coatings category. As shown, dry fog coatings are available as both water-based and solvent-based products, with the lower VOC water-based products accounting for the majority of sales.

Table D-45
Dry Fog Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	24	76,661	367	0.17
Water-Based	27	126,241	182	0.09
Total	51	202,902	252	0.26

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 400 g/l VOC limit for dry fog coatings effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the high complying market share; the limit in current district rules and the National Rule; the fact that most district architectural coating rules have had the same limit for several years; and a review of product literature on coatings included in this category. We also note that no adverse comments were received about the proposed limit.

The VOC limit of 400 g/l for dry fog coatings is found in the all district rules (except Bay Area, Butte, Colusa, Feather River, and Monterey, where the category is exempt). The U.S. EPA's National Architectural Coatings Rule also specifies a VOC limit of 400 g/l. National survey data showed that 84 percent of dry fog coatings sales were at or below 400 g/l. Arizona, Kentucky, New York, New Jersey, Massachusetts, Rhode Island, and the California districts

have the same limit. The U. S. EPA concluded that the evidence shows that dry fog coatings at or below 400 g/l perform acceptably well (U.S. EPA, 1998).

We recommend that the VOC limit for dry fog coatings remain at 400 g/l at this time, the same as in current district rules, state rules, and the National Rule. There is almost 97 percent compliance at 400 g/l.

Table D-46
Dry Fog Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons per day)
400	46	96.60	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Issues:

1. Issue: No comments were received on dry fog coatings and, to our knowledge, no unresolved issues remain.

REFERENCES

Air Resources Board. Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

Technical Review Group and Air Resources Board (TRG/ARB). "ARB-CAPCOA SCM for Architectural Coatings, Technical Support Document." July 1989. (TRB/ARB, 1989)

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards." EPA-453/R-98-006b. August 1998. (U.S. EPA, 1998)

4. Fire-Retardant Coatings - Clear

Product Category Description:

Fire-retardant coatings are used to bring building and construction materials into compliance with federal, State and local building code requirements. The coatings must be fire tested and rated for their ability to retard ignition and flame spread. Both the coatings and the testing agency must be approved by building code officials. Clear fire-retardant coatings include, but are not limited to, clear varnishes and sealers. Fire-retardant coatings used on wood shingles are pressure-applied into the wood in a factory (Ho, 1999), and therefore, are not subject to the architectural coating rule.

Most fire-retardant coatings work by suppressing flame through intumescence, which means they become plastic and puff up on exposure to flame or excessive heat, solidifying into a foam about fifty times as thick as the coating film. This foam insulates the substrate from the flame (LeSota, 1995).

Fire-retardant coatings reduce flame spread on the surface of a material. Fire-retardant coatings are tested in a fire test chamber using ASTM Method E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials." ASTM Method E 84 is used for testing of interior building materials, not those used on the exterior of buildings (Ho, 1999). This method requires that a 25 foot panel of the substrate coated with the fire-retardant coating be exposed to flame for ten minutes. The retarding of flame spread and smoke development are measured, and the coating receives a flame spread rating equating to Class A, B, or C building materials (Bratcher and Alvarez, 1996).

California building codes specify three classes of building materials (which correspond to the Class A, B, and C materials mentioned above), each with a range of possible flame spread indices. The following table summarizes this information (California Building Code, 1998).

Flame-Spread Classification

Building Material Qualified by:	
Class	Flame Spread Index
I	0-25
II	26-75
III	76-200

The California Building Code is based on the Uniform Building Code of the International Conference of Building Code Officials (ICBO), while building codes in the eastern half of the U.S. are usually based on the fire hazard classifications of the National Fire Protection Association (NFPA) (Woods, 1999).

The definition used in the SCM is essentially the National Rule definition, except that we have removed the language pertaining to fire-resistant. During our research on the fire-retardant category, we found that a separate category for fire-resistant coatings was needed because these two categories are quite different in the mode of action, the materials protected, and the test methods used.

The fire-retardant coatings definition in the SCM also differs significantly from the definition used in district rules and the 1989 SCM. These district definitions describe fire-retardant coatings as those that have a flame spread index of less than 25 when tested in accordance with ASTM Designation E 84-87, using Douglas fir as the substrate. This definition is limiting in several ways.

The definition used in district rules specifies a flame spread index of less than 25, but as seen in the table above, this limits the classification of the building materials to Class I (Class A in the NFPA classification). The California Building Code allows Class II and III materials (Class B and C in the NFPA classification) to be used in some applications, for example where the materials are protected on both sides by sprinkler systems (California Building Code, 1998).

The districts' rule definition restricts the flame spread testing to Douglas fir. This is limiting because it precludes testing and certification of fire-retardant coatings on other building materials such as acoustical tiles, drywall, plywood, etc. Manufacturers of fire-retardant coatings are required to test and register their products with the State Fire Marshal's Office, and testing must be on the variety of substrates that the manufacturer claims the coating can be used on, not just Douglas fir (Woods, 1999).

The coatings are tested by a variety of testing laboratories. Each building inspection agency has its own list of approved laboratories for each type of building material (Woods, 1999). In California, most building code officials at the local level use the approved testing laboratories list of the State Fire Marshal (Ho, 1999). These laboratories are further subdivided into those who are qualified and equipped to conduct certain tests and examinations (State Fire Marshal, 1998). The proposed definition does not restrict the choice of testing agencies to a single laboratory such as Underwriters Laboratory. The term "approved laboratory" is used in the industry to imply a lab acceptable to a code official (Hopper, 1999). The term "testing agency" was chosen for the proposed definition based on the terminology used in the California Building Code.

Manufacturers submit their coatings for testing on certain specified building materials to the testing laboratory. The laboratory determines the flame spread and smoke density ratings. The test results are then submitted to the State Fire Marshal for review. If approved, the State Fire Marshal lists the product in its listing service or registry. The manufacturer must pay a fee to register the product in the listing service, and the listing has an expiration date. Both the fire-retardant chemical and the fire-retardant coating must be registered by the State Fire Marshal (Ho, 1999). Architects, contractors, and others who use these coatings have access to the listing of approved coatings.

The reference to federal building codes in the proposed definition is included because federal facilities such as office buildings, courthouses, prisons, hospitals, and military bases are subject to the federal requirements in the NFPA codes, whereas the California requirements are based on the ICBO codes (Woods, 1999).

The test method is important in defining fire-retardant products. The test method for flame spread index is referenced in the Test Methods section of the rule for information purposes. ASTM Designation E-84 is referenced, but the California Building Code references UBC Standard 8-1, which is virtually identical to the ASTM method. Individual testing laboratories also have their own flame spread tests; for example, Underwriters Laboratories uses UL 723, which is virtually the same as ASTM Method E-84 (Hopper, 1999).

Table D-47 below summarizes our estimate of sales and VOC emissions from the clear fire-retardant coatings category.

Table D-47
Clear Fire-Retardant Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	0	0	N/A	N/A
Water-Based	PD	PD	22	~0.00
Total	PD	PD	22	~0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.
PD = Protected Data.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 650 g/l VOC limit for clear fire-retardant coatings effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the high complying market share; the limit in current district rules; the fact that most district architectural coating rules have had the same limit for several years; a review of product literature on coatings included in this category; and discussions with manufacturers. We also note that no adverse comments were received about the proposed limit.

The VOC limit of 650 g/l for clear fire-retardant coatings is found in all district rules (except Bay Area, Butte County, Colusa County, and Feather River, which exempt this category, and Monterey and Placer County, which do not have a category for fire-retardant coatings).

The National Rule VOC limit for clear fire-retardant/resistive coatings is 850 g/l. However, the U.S. EPA does not provide rationale for this VOC limit (U.S. EPA, 1998). We recommend that the VOC limit for clear fire-retardant coatings remain at 650 g/l at this time, the same as in the 1989 SCM and all current district rules. There is 100 percent compliance at

this limit.

Table D-48
Clear Fire-Retardant Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
650	PD	100	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
PD = Protected Data.

Issues:

1. Issue: No unresolved issues remain with this category.

REFERENCES

Air Resources Board. Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

Bratcher, C. and M. Alvarez. "Buying Time with Coatings Technology: Fire-Protective Coatings Reduce Flame Spread." Modern Paint and Coatings. November 1996. (Bratcher and Alvarez, 1996)

California Building Code. Chapter 8, Interior Finishes. 1998. (California Building Code, 1998)

Ho, Ben, Deputy State Fire Marshal. Personal communication with ARB staff. November 29, 1999. (Ho, 1999)

Hopper, Howard, Underwriters Laboratory. Personal communication with ARB staff. October 8, 1999. (Hopper, 1999)

LeSota, Stanley, ed.. *Coatings Encyclopedic Dictionary*. Federation of Societies for Coatings Technology. 1995. (LeSota, 1995)

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards." EPA-453/R-98-006b. August 1998. (U.S. EPA, 1998)

Woods, John, Deputy State Fire Marshal. Personal communication with ARB staff. October 21, 1999. (Woods, 1999)

5. Fire-Retardant Coatings – Opaque

Product Category Description:

Fire-retardant coatings are described in the previous section on clear fire-retardant coatings. Opaque fire-retardant materials include, but are not limited to, coatings with flat or nonflat finishes and primers.

Table D-49 below summarizes our estimate of sales and VOC emissions from the opaque fire- retardant coatings category. As shown, both solvent-based and water-based products are available, with the lower VOC water-based products accounting for the majority of sales.

Table D-49
Opaque Fire-Retardant Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	20	10,297	267	0.02
Water-Based	37	45,912	46	0.01
Total	57	56,209	86	0.03

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 350 g/l VOC limit for opaque fire-retardant coatings effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the high complying market share; the limit in current district rules; the fact that most district architectural coating rules have had the same limit for several years; a review of product literature on coatings included in this category; and discussions with manufacturers. We also note that no adverse comments were received about the proposed limit.

The VOC limit of 350 g/l for opaque fire-retardant coatings is found in all district rules (except Bay Area, Butte County, Colusa County, and Feather River, which exempt this category, and Monterey and Placer County, which do not have a category for fire-retardant coatings).

The National Rule VOC limit for opaque fire-retardant/resistive coatings is 450 g/l. However, the U.S. EPA does not provide a rationale for this VOC limit (U.S. EPA, 1998).

We recommend that the VOC limit for opaque fire-retardant coatings remain at 350 g/l at this time, the same as in the 1989 SCM and all district rules. There is virtually 100 percent compliance at this limit.

Table D-50
Opaque Fire-Retardant Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
350	53	99.80	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Issues:

1. Issue: No unresolved issues remain on this category.

REFERENCES

Air Resources Board. Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards." EPA-453/R-98-006b. August 1998. (U.S. EPA, 1998)

6. Form Release Compounds

Product Category Description:

Form release compounds are products designed for use on concrete forms to prevent freshly poured concrete from sticking to the form. The forms may be wood, metal, or other material other than concrete. They are used extensively in the building industry in concrete pouring operations (TRG/ARB, 1989).

A commenter on the National Rule speculated that concrete form release compounds may be underrepresented in the national Architectural Coatings Survey because they are made by the construction industry, not coating manufacturers (U.S. EPA, 1998). They may also be underrepresented in the ARB's 1998 Architectural Coatings Survey for the same reason.

Table D-51 below summarizes our estimate of sales and VOC emissions from the form release compounds category. Sales were only 10,000 gallons in the 1993 survey, compared to 80,000 gallons in the 1998 survey.

Table D-51
Form Release Compounds*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	9	11,025	247	0.02
Water-Based	4	72,218	2	~0.00
Total	13	83,243	34	0.02

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 250 g/l VOC limit for form release compounds effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the high complying market share; the limit in current district rules; and the fact that most district architectural coating rules have had the same limit for several years. We also note that no adverse comments were received about the proposed limit.

The form release compounds category appears in a few district rules: El Dorado, Imperial, Kern, Placer, Sacramento, San Diego, San Joaquin, Santa Barbara, and Ventura, all with a 250 g/l VOC limit. The category falls under the default limit of 250 g/l in the remaining districts.

In the 1989 SCM, the form release compounds category was created to separate these coatings (at a VOC limit of 250 g/l) from bond breakers (at 750 g/l effective September 1989, lowering to 350 g/l in September 1990). At that time, it was estimated that form release compounds were used in larger quantities than bond breakers (TRG/ARB, 1989).

The VOC limit for form release compounds in the U.S. EPA's National Architectural Coatings Rule is 450 g/l. The National Rule limit is found in the upper range of VOC content limits in existing state rules (U.S. EPA, 1998).

We recommend that the VOC limit for form-release compounds remain at 250 g/l at this time, the same as in current district rules.

Table D-52
Form Release Compounds*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
250	PD	PD	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
PD = Protected Data.

Issues:

1. Issue: No comments were received on form release compounds, and we are unaware of any remaining issues.

REFERENCES

Air Resources Board. Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

Technical Review Group and Air Resources Board (TRG/ARB). "ARB-CAPCOA SCM for Architectural Coatings, Technical Support Document." July 1989. (TRG/ARB, 1989)

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards." EPA-453/R-98-006b. August 1998. (U.S. EPA, 1998)

7. Graphic Arts Coatings

Product Category Description:

Graphic arts coatings or sign coatings are products designed for hand-application by artists using brushes or rollers. They are used on indoor or outdoor signs or murals and include lettering enamels, poster colors, copy blockers, and bulletin enamels. A coating used on the structural components of billboards is not included in the definition. Most billboard signs are now pre-printed and are pasted to the billboard on-site.

The 1989 SCM clarified which graphic arts coatings were subject to architectural coating rules. This was necessary because, depending on the district in which the coating is applied, what substrate is being used, and where they are applied, graphic arts coatings could be subject to metal parts and products, wood products, plastic parts and products, or architectural coatings rules. The definition was designed to address the needs of sign painters without allowing high VOC coatings to be used for jobs not legitimately requiring sign coatings. To be an architectural coating, the sign would have to be coated after installation (TRG/ARB, 1989). Similarly, U.S. EPA clarified that if the coating is applied to an erected billboard, the coating used on the sign portion of the billboard would be classified as graphic arts, while the coating used on the steel supporting beams of the billboard would be an industrial maintenance coating (U.S. EPA, 1998).

Table D-53 below summarizes our estimate of sales and VOC emissions from the graphic arts coating category.

Table D-53
Graphic Arts Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based***	PD	PD	628	0.03
Water-Based	PD	PD	10	~0.00
Total	108	40,366	122	0.03

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.
*** Includes 100 percent solid coatings.
PD = Protected Data.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 500 g/l VOC limit for graphic arts coatings effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the high complying market share; the limit in current district rules; and the fact that most district

architectural coating rules have had the same limit for several years. We also note that no adverse comments were received about the proposed limit.

All districts that have a graphic arts category in their architectural coating rules have a 500 g/l VOC limit. This category is exempt in the Bay Area, Butte County, Colusa County, Feather River, and Monterey districts. The VOC limit in the U.S. EPA's National Architectural Coatings Rule is 500 g/l. National survey data showed that 96 percent of the coatings were 500 g/l or below. Massachusetts, New York, New Jersey, and Rhode Island are at 450 g/l, while Kentucky and the California districts are at 500 g/l (U.S. EPA, 1998)

In earlier versions of the SCM, we proposed lowering the VOC limit for graphic arts coatings to 150 g/l, based on survey data. There is a large waterborne or 100 percent solids component of the survey data that may be non-architectural or may represent sign coatings other than those included in the definition. Based on comments and minimal emission reductions, we changed the proposed VOC limit to match that of district rules and the National Rule.

We recommend that the VOC limit for graphic arts coatings remain at 500 g/l at this time, the same as in current district rules and the National Rule. There is 81 percent compliance at the proposed 500 g/l limit.

Table D-54
Graphic Arts Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
500	18	81.20	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Issues:

1. Issue: There are no known unresolved issues with this category.

REFERENCES

Air Resources Board. Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

Technical Review Group and Air Resources Board (TRG/ARB). "ARB-CAPCOA SCM for Architectural Coatings, Technical Support Document." July 1989. (TRG/ARB, 1989)

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards." EPA-453/R-98-006b. August 1998. (U.S. EPA, 1998)

8. **Magnesite Cement Coatings**

Product Category Description:

Magnesite cement coatings are designed for use on magnesite cement decking to protect the magnesite cement substrate from erosion by water.

Magnesite is a naturally occurring mineral composed of magnesium carbonate. For decades, exterior and interior floors have been made from magnesite because it is lightweight, stronger than concrete, water-resistant, non-combustible, and long-lasting (Magnesite, undated). Since the 1970s, newer materials have replaced magnesite cement in new construction. However, there is still a demand for magnesite cement for repair and retrofit of old magnesite cement (Armstrong, 1999).

Magnesite floors are laid using a formulation containing magnesium oxychloride cement and inert fillers. Clear and pigmented sealers are used to protect these magnesite floors, decks, and stairs from the weather, and to cover older surfaces that are discolored, patched, or worn (Magnesite Flooring System, undated). Magnesium oxychloride is highly alkaline and prevents adhesion of most coatings applied to it. The only successful magnesite cement coatings are acrylic lacquers. Coatings other than acrylic lacquers have failed within a week due to delamination (TRG/ARB, 1989).

Table D-55 below summarizes our estimate of sales and VOC emissions from the magnesite cement coatings category.

Table D-55
Magnesite Cement Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	PD	PD	590	0.14
Water-Based	PD	PD	0	~0.00
Total	5	37,501	589	0.14

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.
PD = Protected Data.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 450 g/l VOC limit for magnesite cement coatings effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the limit in current district rules; and the fact that most district architectural coating rules have had the same limit for several years: discussions with a major manufacturer who has recently developed a complying product; and a technology assessment performed by the SCAQMD in 1996. We also note that no adverse comments were received about the proposed

limit.

The VOC limit for magnesite cement coatings in most district rules is 450 g/l. The Mojave Desert and San Diego districts have a VOC limit of 600 g/l, and several districts do not list this category in their table of standards. The VOC limit in the U.S. EPA's National Architectural Coatings Rule is 600 g/l.

The SCAQMD examined magnesite coatings in its 1996 amendments to Rule 1113. At that time, an interim VOC limit of 600 g/l was established, and as of January 1, 1999, a VOC limit of 450 g/l is now in effect (SCAQMD, 1996). In November 1998, a major manufacturer indicated that after many years of reformulation, they could meet the 450 g/l limit. There are some limitations in using the coating in hot weather, however, which are handled by applying the coating at night (Armstrong, 1999).

We recommend that the VOC limit for magnesite cement coatings remain at 450 g/l at this time, the same as in current district rules.

Table D-56
Magnesite Cement Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
450	PD	PD	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
PD = Protected Data.

Issues:

1. Issue: No comments were received regarding magnesite cement coatings, and to our knowledge there are no unresolved issues.

REFERENCES

Air Resources Board. Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

Armstrong, Alan, Hills Brothers Chemical. Personal communication with ARB staff. October 25, 1999. (Armstrong, 1999)

"Magnesite Flooring System." Undated. http://desertbrand.com/mfs.htm. (Magnesite Flooring System, undated)

"The Many Faces of Desert Brand Magnesite." Undated. http://www.sealers.ffb.htm. (Magnesite, undated)

SCAQMD. "Draft Staff Report for Proposed Amendments to Rule 1113 – Architectural

Coatings." September 26, 1996. (SCAQMD, 1996)

Technical Review Group and Air Resources Board (TRG/ARB). "ARB-CAPCOA SCM for Architectural Coatings, Technical Support Document." July 1989. (TRG/ARB, 1989).

9. Mastic Texture Coatings

Product Category Description:

Mastic texture coatings are products used to cover and conceal holes, cracks, and surface irregularities. These coatings are applied in a single coat, with the dry film at least 10 mils thick.

These coatings are highly viscous water-based or solvent-borne coatings used by homeowners or contractors for interior and exterior masonry (U.S. EPA, 1998). The definition in the 1989 SCM includes a film thickness specification to identify that these coatings are high-build coatings (TRG/ARB, 1989).

Table D-57 below summarizes our estimate of sales and VOC emissions from the mastic texture coatings category.

Table D-57
Mastic Texture Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	PD	PD	223	0.08
Water-Based	PD	PD	79	0.07
Total	56	299,727	118	0.15

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

PD = Protected Data.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 300 g/l VOC limit for mastic texture coatings effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the high complying market share; the limit in current district rules; the fact that most district architectural coating rules have had the same limit for several years; a review of product literature on coatings included in this category; and comments justifying this limit based on performance requirements. We also note that no adverse comments were received about the proposed limit.

All district rules that include a category for mastic texture coatings have a VOC limit of 300 g/l. This category is exempt in the Bay Area, Butte County, Colusa County, Feather River, and Monterey districts. The VOC limit in the U.S. EPA's National Architectural Coatings Rule is also 300 g/l.

Table D-58
Mastic Texture Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
300	56	100	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Issues:

1. Issue: There are no known unresolved issues with this category.

REFERENCES

Air Resources Board. Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

Technical Review Group and Air Resources Board (TRG/ARB). "ARB-CAPCOA SCM for Architectural Coatings, Technical Support Document." July 1989. (TRG/ARB, 1989)

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards." EPA-453/R-98-006b. August 1998. (U.S. EPA, 1998)

10. Metallic Pigmented Coatings

Product Category Description:

Metallic pigmented coatings are products that contain at least 48 grams of elemental metal pigment per liter of coating, as applied. This metal content is equivalent to 0.4 pounds of metal per gallon of coating. SCAQMD Method 318-95, "Determination of Weight Percent Elemental Metal in Coatings by X-Ray Diffraction," is used to determine the metallic content of the coating.

Metallic pigmented coatings produce a dry film that has a metallic appearance. This effect is produced by incorporating fine flakes of various metals (e.g., copper, bronze, aluminum) to the coating. The aluminum can be leafing or nonleafing. Leafing means that the metal is in the form of thin flat flakes that align themselves so that they appear to be floating on or near the surface of the coating (LeSota, 1995).

In the U.S. EPA rulemaking, issues were raised about the inclusion of zinc-rich coatings in the metallic pigmented coating category. Zinc-rich coatings are applied to structural steel beams to prevent corrosion during the construction of large buildings. Zinc-rich coatings are lower in VOC than metallic pigmented coatings because the zinc content of the dry film can be 50 percent or higher. U.S. EPA concluded that creating a separate category for zinc-rich coatings was not warranted, and these coatings fit under the metallic pigmented category (U.S. EPA, 1998).

Inorganic zinc-rich primers are considered metallic pigmented coatings because the elemental zinc particles in the film are held to the surface of the substrate through a non-organic silicate binder (LeSota, 1995). Organic zinc-rich primers are also considered metallic pigmented coatings because elemental zinc powder is used, along with an organic binder such as an epoxy or urethane that holds the pigment to the film (Sherwin-Williams, undated). The pigment zinc oxide (ZnO) does not contain elemental zinc (LeSota, 1995) and thus does not qualify as a source of zinc for metallic pigmented coatings. Aluminum roof coatings are considered metallic pigmented coatings, as are asphalt aluminum roof coatings as long as they have 48 grams of elemental metal pigment per liter of coating, as applied. Bituminous coatings are excluded from the metallic pigmented coating definition in the National Rule, but they have the same VOC limit of 500 g/l.

Table D-59 below summarizes our estimate of sales and VOC emissions from the metallic pigmented coatings category.

Table D-59
Metallic Pigmented Coatings*

	Number of Products	Category Sales (gallons/ year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	119	272,965	456	0.77
Water-Based	6	119,862	137	0.04
Total	125	392,827	358	0.81

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 500 g/l VOC limit for metallic pigmented coatings effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the high complying market share; the limit in current district rules and the National Rule; the fact that most district architectural coating rules have had the same limit for several years; and a review of product literature on coatings included in this category. We also note that no adverse comments were received about the proposed limit.

Every district rule with a metallic pigmented category has a VOC limit of 500 g/l. This category is exempt in the Bay Area, Butte County, Colusa County, Feather River, and Monterey districts. The National Rule VOC limit is also 500 g/l, and includes coatings formulated with zinc pigment. Kentucky, New York, New Jersey, Massachusetts, Rhode Island, and some of the California districts have 500 g/l limits. The national survey showed that 90 percent of these coatings had VOC contents from 300-500 g/l (U.S. EPA, 1998).

In earlier versions of the SCM, we had proposed excluding zinc from the definition of metallic pigmented coatings because zinc-rich primers, which would fall under this category, have a VOC content limit lower than 500 g/l. We are now proposing that the definition include coatings containing elemental zinc, which is consistent with the National Rule and SCAQMD Rule 1113. Further, we have proposed that the most restrictive VOC limit section of the SCM does not apply to metallic pigmented coatings, as has been the case for years in most district rules. Thus, a coating containing the metallic content required by the definition need meet only the 500 g/l VOC limit of metallic pigmented coatings, even though it overlaps with another category.

We recommend that the VOC limit for metallic pigmented coatings remain at 500 g/l at this time, the same as in current district rules and the National Rule. The survey shows 98 percent compliance at this limit, even with solvent-based coatings.

Table D-60
Metallic Pigmented Coatings*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
500	98	98.30	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Issues:

1. Issue: The proposed definition restricts this category to metallic coatings not including zinc metallic coatings. With the introduction of the lower limits, this limitation is unreasonable, and the zinc exclusion should be removed.

Response: We agree, and have removed the exclusion of zinc from the definition.

2. Issue: We manufacture a zinc-rich coating containing zinc powder that contains 95 percent zinc in the dried film and is applied in the field. Zinc is the densest and most difficult metal to formulate into coatings. We urge you to change your definition to include zinc.

Response: We agree with the change in the definition. The coating described would be considered a metallic pigmented coating.

3. Issue: The higher limit for the asphaltic aluminum coating is appropriate because they are the best product for increasing reflectance on black asphaltic roofing surfaces.

Response: The National Rule definition for metallic pigmented excludes bituminous coatings, but we have not proposed similar language, in keeping with the long-standing definition used in California. We agree that this asphaltic aluminum roof coating would be considered a metallic pigmented coating.

4. Issue: The definition for metallic pigmented coatings exempts zinc as a metal, which would essentially eliminate organic and inorganic zinc-rich primers. We request that you change this definition to agree with SCAQMD Rule 1113 and the National AIM Rule definitions.

Response: We agree with the change in the definition to include elemental zinc metal. We also agree that organic and inorganic zinc-rich primers are included in the definition of metallic pigmented coating.

5. Issue: The proposed definition for metallic pigmented coatings excludes zinc. This is surprising since virtually all other regulatory bodies have included zinc. Zinc-rich coatings at 250 g/l have not been proven for field application. Water-based inorganic zinc (which has close to zero VOC) is considered by a majority of applicators and specifiers to be unsuited for field application.

Response: We modified the definition to include zinc-rich coatings as suggested.

6. **Issue:** High temperature metallic coatings shouldn't be penalized because they can be used at high temperature. The use of metallic pigments requires a higher limit because of the metal. The metallic pigmented definition excludes zinc, while the SCAQMD and National Rule include zinc.

Response: We have made the requested change to the definition of metallic pigmented coatings. The exception under the Most Restrictive VOC Limit section in the SCM specifies that high temperature metallic pigmented coatings are subject to the VOC limit for metallic pigmented coatings at 500 g/l.

7. **Issue:** There are a lot of metallic coatings that contain powdered zinc, copper, bronzes based on zinc, and combinations of copper/aluminum/zinc pigments. Pigment is defined in the National Rule to include corrosion inhibition, but pigment is not defined in the SCM. Zinc-rich primers have VOC contents of roughly 340-420 g/l. Zinc-rich primers should be in their own category or in the metallic pigmented category.

Response: The definition of pigment in the National Rule refers to finely ground, insoluble powder that is used for color, corrosion inhibition, and other specific purposes. Thus, zinc in zinc-rich primers would fall under the definition of pigment because they are used for corrosion inhibition, and the coating would be considered a metallic pigmented coating. The decorative metals such as copper and bronze described by the commenter would also be pigments, thus including these coatings in the metallic pigmented coating category. Although some zinc-rich primers have a VOC content considerably less than the 500 g/l limit of metallic pigmented coatings, we are still including them in the metallic pigmented category.

8. **Issue:** Inorganic zinc and zinc containing coatings have always been treated as industrial maintenance (IM) coatings in the SCAQMD, and that's the way they've been reported as well. Metallic coatings contained pure elemental metal, but zinc oxide was included in IM because they didn't qualify as pure metal. Metallic pigmented coatings were originally a decorative coating, so decorative may need to be in the definition.

Response: The commenter is referring to an earlier version of the SCM where zinc coatings were excluded from the definition of metallic pigmented. We have modified the metallic pigmented coating definition to include zinc, consistent with district rules. In the exceptions to the most restrictive VOC limit of current district rules, where a metallic coating is used as primer/sealer/undercoater, roof, high temperature, or industrial maintenance coatings, the higher limit (i.e., metallic pigmented) applies. We do not believe any clarification is required for zinc-rich coatings; the amount of elemental metal should be the deciding factor in determining whether a coating is a metallic pigmented coating, not the type of metal. Zinc oxide is not an elemental metal, and its presence does not make a coating a metallic pigmented coating. We disagree that metallic pigmented coatings are purely decorative. To comply with the definition of metallic pigmented coatings, the amount and the form of the metal are the determining factors, not the function of the metal in the coating.

REFERENCES

Air Resources Board. Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

LeSota, Stanley (ed.). *Coatings Encyclopedic Dictionary*. Federation of Societies for Coatings Technology, 1995. (LeSota, 1995)

Sherwin-Williams Company. Sherwin-Williams Pro-Tips. Inorganic and Organic Zinc Primers. http://www.sherwin.com/Builders/pro-tips/coldweather/primers.asp. Undated. (Sherwin-Williams, undated).

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards." EPA-453/R-98-006b. August 1998. (U.S. EPA, 1998)

11. Pre-Treatment Wash Primers

Product Category Description:

Pre-treatment wash primers are wash coats used prior to the application of primer or topcoat. They must contain at least 0.5 percent acid, by weight, and are applied to bare metal surfaces to provide corrosion resistance and to promote adhesion of subsequent topcoats. Pre-treatment wash primers are often used on aluminum and galvanized metal surfaces (TRG/ARB, 1989).

These coatings provide excellent adhesion when applied to clean alloys, ferrous, or nonferrous surfaces, partially due to a reaction with the substrate. They also impart a corrosion resistant film that is a good surface for the application of coatings. These primers form very thin films, and are similar to etching solutions. The etched surface may be primed for maximum protection (LeSota, 1995).

Table D-61 below summarizes our estimate of sales and VOC emissions from the pre-treatment wash primers category.

Table D-61
Pre-Treatment Wash Primers*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	PD	PD	716	0.00
Water-Based	PD	PD	248	0.04
Total	30	71,940	252	0.04

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.
PD = Protected Data.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 420 g/l VOC limit for pre-treatment wash primers effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the limit in current district rules; and the fact that most district architectural coating rules have had the same limit for several years. We also note that no adverse comments were received about the proposed limit.

The most common district VOC limit for pre-treatment wash primers is 420 g/l. This limit is in the following districts: Imperial, Kern, Sacramento, San Joaquin, Santa Barbara, and Ventura districts. El Dorado and Placer districts have a VOC limit of 675 g/l, while Antelope Valley, Mojave, San Diego, and South Coast have a limit of 780 g/l. The remaining districts do

not include a category for pre-treatment wash primers.

The 1989 SCM set the VOC limit at 780 g/l, effective September 1989, and a future-effective limit of 420 g/l VOC limit in September 1994 (TRG/ARB, 1989).

A variety of district coating rules (e.g., Bay Area Rule 8-43, Surface Coating of Marine Vessels; Sacramento Rule 451, Surface Coatings of Miscellaneous Metal Parts and Products; San Joaquin Rule 4603, Surface Coating of Metal Parts and Products; and Ventura Rule 74.12, Surface Coating of Metal Parts and Products) have categories for pre-treatment wash primers, with a VOC limit of 420 or less.

The VOC limit in the U.S. EPA's National Architectural Coatings Rule is 780 g/l. However, we recommend that the VOC limit for pre-treatment wash primers remain at 420 g/l at this time, the same as most district architectural coating rules and several other district metal coating rules. Although the SCAQMD has a higher limit than that proposed in the SCM, the statewide emission reductions are still virtually zero.

Table D-62
Pre-Treatment Wash Primers*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
420	PD	PD	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
PD = Protected Data.

Issues:

1. We know of no unresolved issues with this category.

REFERENCES

Air Resources Board. Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

LeSota, Stanley (ed.). *Coatings Encyclopedic Dictionary*. Federation of Societies for Coatings Technology. 1995. (LeSota, 1995)

Technical Review Group and Air Resources Board (TRG/ARB). "ARB-CAPCOA SCM for Architectural Coatings, Technical Support Document." July 1989. (TRG/ARB, 1989)

12. Sanding Sealers (Non-Lacquer)

Product Category Description:

Sanding sealers are clear coatings applied to bare wood to seal the wood and provide a coat that can be sanded smoothly. This category does not include lacquer-type sanding sealers. The application of a sanding sealer to wood provides a first coat that is quite hard, and seals or fills the wood, but it does not conceal the wood grain (LeSota, 1995). Lacquer sanding sealers are included in the lacquer category because they perform essentially like lacquers (U.S. EPA, 1998).

The sanding sealer category was added to the 1989 SCM by the direction of our Board at its May 12, 1989 hearing. The definition specified that these coatings are to be used prior to the application of varnish, and that they must be labeled accordingly (ARB, 1989). We are proposing the use of the U.S. EPA's National Architectural Coatings Rule definition because it is more descriptive of the function of sanding sealers and does not direct which topcoat must be used. The definition does, however, clarify that lacquer sanding sealers are to be included in the lacquer category.

In general, non-lacquer sanding sealers are water-based acrylics or urethanes, and are recommended for use with water-based stains and polyurethane varnishes. In general, solvent-based lacquer sanding sealers are used in conjunction with solvent-based stains and clear lacquer or alkyd topcoats. There are exceptions to these statements, however.

Table D-63 below summarizes our estimate of sales and VOC emissions from the non-lacquer sanding sealers category.

Table D-63
Sanding Sealers (Non-Lacquer)*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	26	110,767	665	0.46
Water-Based	5	5,166	281	~0.00
Total	31	115,933	648	0.46

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 350 g/l VOC limit for non-lacquer sanding sealers effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the limit in current district rules; the fact that most district architectural coating rules have

had the same limit for several years; and the fact that several complying water-based products were reported in the survey. We also note that no adverse comments were received about the proposed limit.

Several districts have a VOC limit for sanding sealers of 350 g/l (Antelope, Imperial, Kern, Sacramento, San Joaquin, Santa Barbara, and South Coast), while others have a 550 g/l limit (Mojave and San Diego). Three other districts (El Dorado, Placer, and Ventura) have a 350 g/l limit for non-lacquer sanding sealers. The VOC limit in the U.S. EPA's National Architectural Coatings Rule is 550 g/l.

We recommend that the VOC limit for non-lacquer sanding sealers remain at 350 g/l at this time, the same as in most of the district rules. In contrast to current district rules, we are recommending that the sanding sealers category represent only non-lacquer products because non-lacquer sanding sealers are usually recommended for use with varnishes, while lacquer sanding sealers are used with lacquer topcoats.

Table D-64
Sanding Sealers (Non-Lacquer) *

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
350	5	4.50	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Issues:

1. Issue: We can not make sanding sealers and a number of other categories of the quality, application flexibility and chemical composition safety our customers expect at the very low limits currently proposed.

Response: The 350 g/l VOC limit has been in effect in most of the district rules for many years, and the survey and our technical analysis shows that there are a number of complying products with acceptable performance characteristics.

2. Issue: Since you have a limit for waterproofing sealers and for sanding sealers, what about waterproofing wood sanding sealers? It is a waterproofing sealer as well as a sanding sealer.

Response: The SCM specifies where there are two or more uses for the product, the lowest VOC content limit applies, i.e., the 250 g/l waterproofing wood sealer limit.

REFERENCES

Air Resources Board. Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

Air Resources Board. ARB-CAPCOA SCM for Architectural Coatings, letter to Air Pollution Control Officers. July 7, 1989. (ARB, 1989).

LeSota, Stanley (ed.). *Coatings Encyclopedic Dictionary.* Federation of Societies for Coatings Technology. 1995. (LeSota, 1995)

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards." EPA-453/R-98-006b. August 1998. (U.S. EPA, 1998)

13. Shellac – Clear

Product Category Description:

Shellacs can be clear or opaque and are formulated with the resinous secretions of the lac beetle, *Laccifer lacca*. Shellac coatings are designed to form a uniform coat regardless of how many layers are applied. Each layer of shellac that is applied partially dissolves the previous coat. Shellac Coatings are products, which contain alcohol and dry by evaporation without a chemical reaction. It is for this reason that shellacs are also easily removed.
(Angelo Brothers, 1965; Martin, undated)

Clear shellac coatings are designed to protect the substrate with a durable, protective film that allows full and total transmission of light. Clear shellac coatings are typically sold as bleached or natural. Shellac coatings, in which pigment is artificially added, are considered opaque shellacs (See Shellac – Opaque). (Hoyas, 1999; Zinsser, 1996)

Clear shellacs were a regulated category in the 1989 SCM and the U.S. EPA regulates them in the National Rule. According to the U.S. EPA, the majority of state rules define shellac broadly as a coating formulated with natural resins with nitrocellulose resins excluded to avoid overlap with the lacquer category.(TRG/ARB, 1989; U.S. EPA, 1998) While we understand the U.S. EPA's rationale for their definition of shellac, we do not believe that this is an appropriate change for the SCM. District rules have defined shellac as proposed in the SCM for at least the past ten years. In addition to California, several other states use the proposed SCM definition as well. We believe that the U.S. EPA definition may increase emissions in this category, may cause confusion to the consumers, and will be difficult to enforce because of the inherent problems associated in defining "natural resin." Shellacs have always been specific to the lac beetle. Due to the limited availability of lac beetles, potential use of shellac as a quick-dry primer, general-purpose primer and clear wood finish is minimized.

Using the U.S. EPA definition would expand the availability of high VOC products, and may potentially reduce the emission reductions in two other categories: 1) quick dry primers, sealers, and undercoaters; and 2) primers, sealers, and undercoaters. Outside of California, these alcohol-thinned, non-laccifer lacca, natural resin products are marketed as quick-dry primers, sealers, and undercoaters; or primers, sealers, and undercoaters. We believe that there are acceptable alternatives to these products in the quick-dry, specialty, or general primers, sealers, and undercoaters categories.

Table D-65 below summarizes our estimate of sales and VOC emissions from the shellac-clear coatings category.

Table D-65
Shellac - Clear*

	Number of Products	Category Sales (gallons/ year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	PD	PD	614	0.11
Water-Based	0	0	N/A	N/A
Total	PD	PD	614	0.11

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.
PD = Protected Data.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a VOC limit of 730 g/l for clear shellacs effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible by the effective date based on the complying market share, the limit in current district rules, and the length of time that these limits have been in effect. The proposed limit is consistent with the 1989 SCM, district rules, and the National Rule. The ARB survey data show 100 percent compliance with the proposed limit.

Table D-66
Shellac - Clear*

Proposed VOC Limit (g/l)**	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
730	PD	100	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
PD = Protected Data.

Issues:

1. Issue: The commenters urge CARB not to modify the definition of shellac in the current or future versions of air control measures. The commenters state that the U.S. EPA has allowed the category of shellac to be reinterpreted, to become confused and to become a "loophole" for manufacturers wishing to violate the spirit of the original CARB regulations put forth many years ago.

Response: We agree with the commenter and have, therefore, changed the shellac definition back to its previous wording. Shellacs shall include only those coatings that are solely formulated with the resinous secretions of the lac beetle (L*accifer lacca*), which is how shellac has been defined for hundreds of years. The proposed definition is consistent with the 1989 SCM's shellac definition, and is the most common shellac definition found in the California districts' architectural coatings rules. Since the shellac category has been regulated for many

years and the VOC limit is relatively high, it is important that we limit the definition so that our emission reductions are not compromised. Coatings containing other natural resins may continue to use the most applicable coating category, just as they have in the past. We believe that any substantial change to the definition will not only confuse consumers, but also may reduce our estimated emission reductions.

2. **Issue:** The commenter urges the ARB to return to the original definition of shellac. If not, the commenter believes this change in the shellac definition will result in a number of unintended consequences, all of which will certainly increase the amount of VOC emissions, both near and long term.

Response: We agree with the commenter and have changed the shellac definition back to its previous wording. See response to Issue 1.

3. **Issue:** Both in person and in writing, we have requested language uniformity with the National AIM VOC Rule. By changing the definition for shellac we feel you have created a monopolistic situation for the users of paint in California. This does not lead to less air pollution; rather it leads to a more costly less available single product source for extreme stain blocking needs.

Response: We disagree with the commenter. We do not believe that it is appropriate to change the definition to include all natural resins. Shellacs were broken out of the lacquer category many years ago to address the unique formulation. Outside of California, these other natural resin products are marketed as quick-dry primers, sealers, and undercoaters; or primers, sealers, and undercoaters. There are acceptable alternatives to these products in the quick-dry, specialty, or general primers, sealers, and undercoaters categories. Changing the shellac definition may reduce the emission reductions and sales in the quick-dry and general primers, sealers, and undercoaters categories and increase sales and emissions in the revised shellac category. Currently, cost and availability limit shellac coatings sales. The high cost of the coating makes it prohibitive for use as a general primer, sealer, and undercoater.

4. **Issue:** For shellac, ARB reverted to the older definition in SCM and district rules, where shellac is limited to the secretions of the lac beetle. We spent a lot of time in the national negotiations making the federal folks aware that the one resin was not the only substance in the world that performed the function of sealing in alcohol. Functionality and product quality is not limited to lac beetle resin.

Response: We disagree. Please see response to Issue 3.

REFERENCES

Air Resources Board. Final Report, "1998 Architectural Coatings Survey Results." September, 1999. (ARB, 1999)

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14. Shellac - Opaque

Product Category Description:

Shellacs can be clear or opaque and are formulated with the resinous secretions of the lac beetle, *Laccifer lacca*. Shellac coatings are designed to form a uniform coat regardless of how many layers are administered. Each coating layer partially dissolves the previous coat and dries to form one thicker coat. Shellac coatings are products, which use ethyl alcohol as the primary solvent and dry by evaporation without a chemical reaction. It is for this reason that shellacs are also easily removed. (Angelo Brothers, 1965; Martin, undated)

Opaque shellac coatings are designed to protect the substrate with a durable, protective film. This film layer does not allow full and total transmission of light. Opaque shellac coatings are typically white and are rarely tinted. Shellac coatings in which any pigment is artificially added are considered opaque shellacs. (Hoyas, 1999; Zinsser, 1999; Zinsser,1995)

Opaque (pigmented) shellacs were a regulated category in the 1989 SCM and the U.S. EPA regulates them in the national rule. According to the U.S. EPA, the majority of state rules define shellac broadly as a coating formulated with natural resins, with nitrocellulose resins excluded to avoid overlap with the lacquer category. Although the definitions may change from state to state, all state rules reviewed have 550 g/l limit for opaque shellacs. For a more detailed discussion on the definition of shellac, please see the Clear Shellac discussion for additional information. (TRG/ARB, 1989; U.S. EPA, 1998)

Table D-67 below summarizes our estimate of sales and VOC emissions from the shellac - opaque coatings category.

Table D-67
Shellac - Opaque*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	PD	PD	534	0.41
Water-Based	0	0	N/A	N/A
Total	PD	PD	534	0.41

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
****** Grams VOC per liter of coating, less water and exempt compounds.
PD = Protected Data.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a VOC limit of 550 g/l for opaque shellacs effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible by the effective date

based on the following items: the complying market share; the limit in current district rules; and the length of time that these limits have been in effect.

This proposed limit is consistent with the 1989 SCM, district rules, and the National Rule. Certain applications of shellac require thinning to meet customer needs. Although the sales weighted average for opaque shellac is near the proposed limit of 550 g/l, 100 percent of the market complies with the proposed limit, even with recommended thinning.

Table D-68
Shellac - Opaque*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
550	PD	100	0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).
PD = Protected Data.

Issues:

1. Issue: Please see previous section on clear shellacs.

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Wm. Zinsser & Co., Inc. B-I-N Primer-Sealer Z1514 1/95 09SS. Sommerset, NJ. (Zinsser, 1995)

15. Varnishes

Product Category Description:

Varnishes are clear or semi-transparent coatings that may contain a small amount of pigment to color the surface, or to control the final sheen or gloss of the finish. The varnish category excludes lacquers and shellacs, which dry by evaporation. Varnishes used on floors are subject to the varnish VOC limit rather than the floor coating VOC limit.

The definition in the proposed SCM is essentially the same as that in the U.S. EPA's National Architectural Coatings Rule definition. The definition used in the 1989 SCM defines varnishes simply as clear wood finishes formulated with various resins to dry by chemical reaction on exposure to air. We believe that the National Rule definition is more descriptive of the characteristics of the finished film, which distinguishes varnishes from shellacs and lacquers. The distinguishing characteristics of shellacs and lacquers are their ingredients, lac beetle exudate and cellulosic or synthetic resins, respectively. Varnishes are commonly made with alkyds, urethanes, polyurethanes, phenols, and modified resin systems, and they are characterized by a hard film that can be formulated to resist abrasion, chemicals, acids, alkalis, alcohol, steam, hot grease, salt water, gasoline, or solvents.

The primary criticisms of varnishes are their tendency to dry slowly and to yellow (TRG/ARB, 1989). Varnishes yellow because they are made with oils that naturally yellow as they age, although some oils yellow less than others. In some woods, the yellowing can enhance the richness of the wood (Marino). In general, water-based polyurethanes yellow less than oil-based varnishes. The drying times vary greatly depending on the formulation, but in general it is true that varnishes dry-to-recoat more slowly than lacquers.

Table D-69a below summarizes our estimate of sales and VOC emissions from the varnish coatings category.

Table D-69a
Clear Varnishes*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	257	445,397	463	1.29
Water-Based	84	172,031	260	0.11
Total	341	617,428	406	1.40

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

Table D-69b
Semitransparent Varnishes*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	67	100,292	459	0.29
Water-Based	23	61,917	296	0.05
Total	90	162,209	396	0.34

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 350 g/l VOC limit for varnishes effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the complying market share; the limit in current district rules; the fact that most district architectural coating rules have had the same limit for several years; and the results of performance testing in the Harlan study. We also note that no adverse comments were received about the proposed limit.

All districts except one have a VOC limit for varnishes of 350 g/l (Butte County has a VOC limit of 650 g/l.).

The National Rule VOC limit is 450 g/l. Rules in Kentucky, Massachusetts, New Jersey, New York, and Rhode Island have a limit of 450 g/l, Arizona and California districts (except Butte County) have a limit of 350 g/l, and Texas has a limit of 540 g/l. The national survey showed that 30 percent of sales were below 450 g/l. Varnishes recommended for floor coatings are subject to the varnish VOC limit (U.S. EPA, 1998).

From the sales weighted average survey data in Tables D-68a and D-68b above, it appears that only the water-based varnishes comply with the 350 g/l VOC limit. However, in Tables D-69a and D-69b below, it can be seen that roughly 50 percent of the market share complies with the 350 g/l VOC limit. The complying products include both water-based and solvent-borne products.

The ARB survey data show that in varnishes overall (a composite of clear and semi-transparent), about 30 percent of the water-based products and 18 percent of the solvent-borne products comply with the 350 g/l VOC limit that has been in effect in district rules for many years. There are differences in compliance between clear and semi-transparent varnishes, however. In water-based coatings, 28 percent of the clear varnishes comply, while 38 percent of the semitransparent varnishes comply. In solvent-borne coatings, 13 percent of the semitransparent varnishes comply, compared to 20 percent of the clear varnishes.

The 1995 Harlan Associates study (Harlan, 1995; Cowan, 1998) provides some insights on the performance of two water-based and three solvent-borne varnishes. Varnishes have not

yet replaced lacquers as the product of choice for professional painters. The main advantages claimed for the use of lacquers rather than varnishes in the past include clarity, non-yellowing, quick drying and ease of touch-up. Except for ease of touch-up, many of the differences between lacquers and varnishes have narrowed with newer products. Test data shows that, in general, dry times are longer for varnishes than lacquers, but the two complying water-based varnishes dried faster than the solvent-borne products. Similarly, the differences between the high-VOC varnish and the other low VOC varnishes are small. Equivalent characteristics include hardness, application, appearance, flexibility, and gloss. Overall, the abrasion resistance of the low-VOC varnishes was superior to the high-VOC varnish tested. Similarly, the adhesive properties and resistance to water stains of the low-VOC varnishes were superior to the high-VOC varnish. The dry time for two of the low-VOC varnishes was shorter than the high VOC varnish, while the other two low-VOC varnishes did not have any grain raising problems. Sometimes, these coatings are applied as a system, with the stain followed by a sanding sealer and varnish topcoat. Thus, grain raising would not be a concern for this type of coating operation. Long-term testing was not conducted in the Harlan study, so no conclusions can be drawn about the yellowing tendency of each product. However, overall the low VOC products tested were at least as good as the high VOC product.

We recommend that the VOC limit for clear and semitransparent varnishes remain at 350 g/l at this time, the same as in most district rules. There are an adequate number of complying products in water-based and solvent-borne, clear and semitransparent varnishes, to justify these limits. Also, this limit has been in effect in the three largest districts since September 1987 (TRG/ARB, 1989). We cannot justify recommending a relaxation of the rule for the 17 districts that have the 350 g/l VOC limit.

Table D-70a
Clear Varnishes*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
350	146	47.60	0.00

***** Based on ARB's 1998 Architectural and Industrial Maintenance Coatings Survey (ARB, 1998).
** Grams VOC per liter of coating, less water and exempt compounds.

Table D-70b
Semitransparent Varnishes*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
350	28	51.50	0.00

***** Based on ARB's 1998 Architectural and Industrial Maintenance Coatings Survey (ARB, 1998).
** Grams VOC per liter of coating, less water and exempt compounds.

Issues:

1. Issue: There are no known unresolved issues with this category.

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16. Wood Preservatives

Product Category Description:

Wood preservatives are products designed to protect exposed wood from decay or insect attack. Wood preservatives do not form films, but rather penetrate the wood (U.S. EPA, 1998; LeSota, 1995). These coatings are registered with both the U.S. EPA under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the California Department of Pesticide Regulation (DPR). Because of the time required for product registration under FIFRA, the U.S. EPA provided an additional six months for compliance with the VOC limits (U.S. EPA, 1998).

Based on a workshop comment, we are changing the definition of wood preservatives to clarify that the coating, rather than just the preservative chemical, must be registered with the U.S. EPA and DPR. In fact, both the coating and the chemical must be registered (Saldana, 1999). This was the intent of the 1989 SCM (TRG/ARB, 1989), and does not represent a change in strategy or interpretation. Further, in the 1989 SCM and district rules, this category was subdivided into below ground wood preservatives, clear and semitransparent wood preservatives, and opaque wood preservatives. We are proposing to collapse all wood preservatives into a single category.

Table D-71a-71d below summarizes our estimate of sales and VOC emissions from the wood preservatives categories.

Table D-71a
Below Ground Wood Preservatives*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	PD	PD	352	0.01
Water-Based	PD	PD	350	~0.00
Total	PD	3,549	350	0.01

***** Based on ARB's 1998 Architectural and Industrial Maintenance Coatings Survey (ARB, 1998).
****** Grams VOC per liter of coating, less water and exempt compounds.
PD = Protected Data.

Table D-71b
Clear Wood Preservatives*

	Number of Products	Category Sales (gallons/ year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	8	157,119	141	0.14
Water-Based	12	67,123	102	0.02
Total	20	224,242	129	0.16

***** Based on ARB's 1998 Architectural and Industrial Maintenance Coatings Survey (ARB, 1998).
****** Grams VOC per liter of coating, less water and exempt compounds.

Table D-71c
Semitransparent Wood Preservatives*

	Number of Products	Category Sales (gallons/ year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	12	138,757	390	0.34
Water-Based	13	7,163	218	~0.00
Total	25	145,920	382	0.34

***** Based on ARB's 1998 Architectural and Industrial Maintenance Coatings Survey (ARB, 1998).
****** Grams VOC per liter of coating, less water and exempt compounds.

Table D-71d
Opaque Wood Preservatives*

	Number of Products	Category Sales (gallons/ year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast AQMD) (tons/day)
Solvent-Based	PD	PD	658	~0.00
Water-Based	PD	PD	132	~0.00
Total	PD	PD	140	~0.00

***** Based on ARB's 1998 Architectural and Industrial Maintenance Coatings Survey (ARB, 1998).
****** Grams VOC per liter of coating, less water and exempt compounds.
PD = Protected Data.

Proposed VOC Limit and Basis for Recommendation:

We are proposing a 350 g/l VOC limit for wood preservatives effective January 1, 2003. This proposed VOC limit is technologically and commercially feasible based on: the high complying market share; the limit in current district rules; and the fact that most district architectural coating rules have had the same limit for several years. We also note that no adverse comments were received about the proposed limit.

As mentioned above, there are three categories of wood preservatives currently in most district rules, all with the same VOC limit. Below ground wood preservatives have a 350 g/l VOC limit in all districts except Mojave and San Diego, where they have a 600 g/l limit. Below ground wood preservatives are exempt in the Bay Area, Butte County, Colusa County, Feather River, and Monterey districts. Clear and semitransparent wood preservatives have a 350g/l VOC limit in all districts except Butte County (700 g/l). Opaque wood preservatives have a 350 g/l limit in all districts except Butte (650 g/l).

In the 1989 SCM, the clear and semitransparent wood preservatives had a 350 g/l VOC limit. The category for below ground wood preservatives was established with a VOC limit of 600 g/l. Three years later, in 1992, the SCM consolidated below ground wood preservatives and opaque wood preservatives with a VOC limit of 350 g/l. The three years was provided to reformulate below ground wood preservatives and to allow registration of the products under FIFRA and the California Department of Food and Agriculture (now DPR). Commenters claimed that registration could take up to two years (TRG/ARB, 1989).

The National Rule VOC limit is 550 g/l for below ground wood preservatives, 550 g/l for clear and semitransparent wood preservatives, and 350 g/l for opaque wood preservatives. Several states (Kentucky, Massachusetts, New Jersey, New York, Rhode Island) have 550 g/l limit for clear and semitransparent wood preservatives, while California districts (except Butte County) and Arizona have a 350 g/l limit (U.S. EPA, 1998).

Because all wood preservatives categories have been at 350 g/l in most district rules since 1992, we recommend collapsing all wood preservatives categories (i.e., clear, semitransparent, opaque, and below ground) into one category known as wood preservatives, with a VOC limit of 350 g/l. The survey showed that there is high compliance in all types of wood preservatives, and the function and registration process is similar for each. Also, since this limit has been in effect in most districts, we do not believe additional time for registration is needed.

Table D-72a
Below Ground Wood Preservatives*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
350	PD	PD	0.00

***** Based on ARB's 1998 Architectural and Industrial Maintenance Coatings Survey (ARB, 1998).
PD = Protected Data.

Table D-72b
Clear Wood Preservatives*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
350	16	94.70	0.00

***** Based on ARB's 1998 Architectural and Industrial Maintenance Coatings Survey (ARB, 1998).
** Grams VOC per liter of coating, less water and exempt compounds.

Table D-72c
Semitransparent Wood Preservatives*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
350	20	74.10	0.00

***** Based on ARB's 1998 Architectural and Industrial Maintenance Coatings Survey (ARB, 1998).

Table D-72d
Opaque Wood Preservatives*

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Market Share (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
350	PD	PD	0.00

***** Based on ARB's 1998 Architectural and Industrial Maintenance Coatings Survey (ARB, 1998).
PD = Protected Data.

Issues:

1. Issue: No known unresolved issues remain with this category.

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C. CATEGORIES NOT PROPOSED FOR INCLUSION IN THE SCM

The following 16 coating categories are not included in the proposed SCM, but are included in the U.S. EPA's national architectural coatings rule. The discussion of each of these coating categories includes: 1) a product category description; 2) a rational for not including the product category in the proposed SCM; and 3) if applicable, a discussion of the issues associated with the category, as raised by industry. The product categories are listed in alphabetical order.

With the exception of antigraffiti coatings, these categories are not generally included in any of California's district architectural coatings regulations. The products under these categories are currently either: (1) subject to other coating categories in district regulations; (2) sold only under the small container exemption; or (3) not sold in California (at least in areas with architectural coatings rules). Nevertheless, we researched each of these categories because they were included in the U.S. EPA's architectural coatings regulation, and because in many cases these products will be subject to lower VOC limits under the proposed SCM compared to current district regulations. In researching these categories we considered a variety of factors, including: (1) the VOC limit they would be subject to under the proposed SCM; (2) the potential for reformulation as demonstrated by similar products already complying with the VOC limits in the proposed SCM; (3) the availability of products that do not fall under the category as defined in the national rule, but fulfill the same basic function at a lower VOC content; and (4) the extent to which products under the category are used in California. As explained in the following sections, we do not believe it is necessary to incorporate a new category and VOC limit for any of these categories.

1. Anti-graffiti Coatings

Product Category Description:

Anti-graffiti coatings, as defined in the U.S. EPA's architectural coatings regulation, are clear or opaque high performance coatings formulated and recommended for application to interior and exterior architectural structures such as walls, doors, partitions, fences, signs, and murals to deter adhesion of graffiti and to resist repeated scrubbing and exposure to harsh solvents, cleansers, or scouring agents used to remove graffiti (U.S. EPA, 9/11/98). Notwithstanding this definition, anti-graffiti products are available as both permanent *and* sacrificial coatings. Permanent anti-graffiti products are generally two-part polyurethane coatings that resist repeated scrubbing and exposure to harsh solvents, cleansers, or scouring agents, as mentioned in the U.S. EPA's definition. Sacrificial products, on the other hand, provide a layer on top of the substrate that can be removed with hot water or other cleansers if graffiti is applied (Sinak, 12/15/99, telephone conversation; Genesis Coatings, 12/13/99; Spectratone, 12/15/99). The sacrificial products are then applied over the affected area to renew the coating.

As shown in the table below, the anti-graffiti coatings that reported in the ARB's Architectural Coatings Survey include both solvent-borne and water-borne coatings, with the solvent-borne coatings accounting for the majority of emissions. According to the ARB's Architectural Coatings Survey, about 2,573 gallons of anti-graffiti coatings were sold in 1996.

Table D-73
Anti-Graffiti Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast) (tons/day)
Solvent-Based	PD	PD	605	~0.00
Water-Based	PD	PD	92	~0.00
Total	4	2,573	225	~0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

PD = Protected data.

Rationale for Not Including Product Category in the SCM:

In the U.S. Environmental Protection Agency's national Architectural and Industrial Maintenance Rule, the permanent (not sacrificial) anti-graffiti coatings are regulated as a separate category with a 600 g/l VOC limit. However, in the ARB's SCM, anti-graffiti coatings would be classified as either: (1) industrial maintenance coatings with a 250 gram/liter VOC limit; or (2) as general flat or nonflat coatings with a 100 or 150 gram/liter VOC limit, respectively. Permanent anti-graffiti coatings would generally be classified as industrial maintenance coatings (unless they are designed for residential use) because they are designed to resist repeated scrubbing and exposure to harsh solvents, cleansers, or scouring agents. Sacrificial anti-graffiti coatings (or permanent anti-graffiti coatings for residential use) would generally be classified under the flat or nonflat coatings categories because they do not meet the criteria of an industrial maintenance coating.

We do not believe it is necessary to create a separate category with a higher VOC limit for anti-graffiti coatings because there are numerous manufacturers that currently produce products that comply with the proposed limits in the SCM (Sinak, 12/15/99, telephone conversation; Textured Coatings of America, 12/13/99; Aquarius Coatings, 9/98; Genesis Coatings, 12/13/99; Spectratone, 12/15/99). In addition, the sales-weighted average VOC content of the anti-graffiti products reported in the ARB's survey is 225 g/l (ARB, 9/99). The complying products include both permanent and sacrificial products, and many of these products have a VOC content at or near zero. We also note that some of the complying products are approved for use by the California Department of Transportation (CalTrans, 12/21/99; Sinak, 12/15/99, product literature).

Issues:

1. Issue: Anti-graffiti coatings go on apartment buildings, but if they are classified as industrial maintenance coatings, they would be prohibited under industrial maintenance restrictions in residential areas. With small volumes for these coatings, it will not be economically feasible for manufacturers to reformulate, and it will not produce significant emission reductions.

Response: There are numerous anti-graffiti products, both permanent and sacrificial, that currently meet the 100 and 150 g/l VOC limits proposed for flat and nonflat coatings. Many of these products are zero, or near-zero VOC water-based products. These products could be used on apartment buildings and other residential areas. While each manufacturer will need to evaluate whether it is economically justified to reformulate higher VOC products to the proposed levels, many have already found it feasible to formulate low-VOC products, as demonstrated by the numerous complying formulations offered on the market.

2. Issue: Anti-graffiti coatings should be included in the SCM at VOC limit of 600 g/l. This limit is needed for permanent anti-graffiti coatings based on solvent-borne polyurethane chemistry. Permanent coatings allow cleaning of subsequently applied graffiti for surfaces that cannot be repainted, such as murals. After cleaning, the anti-graffiti system does not need to be reapplied, and also reduces the repainting, and thereby reduces VOC emissions over time. The volumes sold are very small, and averaging is not possible with our product line.

Response: As mentioned above, there are numerous permanent anti-graffiti coatings. These products are generally water-based two-part polyurethane coatings.

3. Issue: Anti-graffiti should be a separate category. There are sacrificial coatings, but the high performance ones are made with highly reactive urethane to get the cross-linking and reduce porosity and need 600 g/l. The true way to measure an anti-graffiti coating is to let graffiti cook in the sun for 7-10 days and try to clean without residue. Anti-graffiti systems are also available as a primer, clear coat, and colored coat, but not a clear coat—could this definition be worded to include an anti-graffiti system for water tanks with 340 g/l limit for each individual product

Response: As mentioned above, there are numerous permanent anti-graffiti coatings on the market that comply with the proposed VOC limits for flat and nonflat coatings. These coatings are generally two-part urethane systems, except that they are water-based instead of solvent-based. We do not have any specific information on the ease of removal of baked-on graffiti as mentioned by the commenter. We also do not have any information to justify changing the anti-graffiti definition or limit as proposed by the commenter.

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Genesis Coatings, Incorporated. Product Data Sheets for GCP 1000 and Graffiti Melt. Facsimile dated 12/13/99. (Genesis Coatings, 12/13/99)

Sinak Corporation. Product literature on Sinak GPS and Topcoat-17. Facsimile dated December 15, 1999. (Sinak, 12/15/99, product literature)

Sinak Corporation. Telephone conversation with ARB staff. December 15, 1999. (Sinak, 12/15/99, telephone conversation)

Spectratone Company. Telephone conversation with ARB staff. December 15, 1999. (Spectratone, 12/15/99)

Textured Coatings of America, Incorporated. Telephone conversation with ARB staff. December 13, 1999. (Textured Coatings of America, 12/13/99)

United States Environmental Protection Agency. National Volatile Organic Compound Emission Standards for Architectural Coatings. 40 CFR Part 59, Subpart D, 63 FR 48848. September 11, 1998. (U.S. EPA, 9/11/98)

2. Calcimine Recoater Coatings

Product Category Description:

Calcimine recoaters, as defined in the U.S. EPA's architectural coatings regulation, are flat solvent-borne coatings formulated and recommended specifically for recoating calcimine coated ceilings and other calcimine coated substrates (U.S. EPA, 9/11/98). Calcimine (or "powdered distemper" in Britain) is a water-thinned coating composed primarily of calcium carbonate and glue. Calcimine coatings are found in Victorian and Early American homes, especially on ceilings. Calcimine *recoaters* are light, puffy, gel-like coatings made of limed vegetable oils. They prevent peeling of old calcimine ceilings because they are solvent-based (calcimine is water soluble) and light (heavier coatings may cause calcimine to disbond). These coatings prevent the need to scrape off all the old calcimine coating prior to recoating.

We are not aware of any sales of calcimine recoaters in California. We are only aware of one manufacturer of these coatings. This manufacturer stated that these products are unique to the New England area (California Products Corporation, 12/10/99).

Rationale for Not Including Product Category in the SCM:

A category for calcimine recoaters was added to the U.S. EPA's national architectural coatings rule, with a VOC limit for 475 g/l. However, we do not believe it is necessary to include this category in the proposed SCM. As mentioned above, these coatings are not generally used in California. Also, no district rules include a category with a higher VOC limit for calcimine recoaters. This indicates that these coatings are not used in California because they generally contain a VOC content of 450 to 465 g/l (USEPA, 8/98), and the VOC limit for flat coatings is 250 g/l or lower in California's district rules.

REFERENCES

California Products Corporation. Telephone conversation with ARB staff. December 10, 1999. (California Products Corporation, 12/10/99).

United States Environmental Protection Agency. National Volatile Organic Compound Emission Standards for Architectural Coatings. 40 CFR Part 59, Subpart D, 63 FR 48848. September 11, 1998. (U.S. EPA, 9/11/98)

United States Environmental Protection Agency. "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards." EPA-453/R-98-006b. August 1998. (USEPA, 8/98)

3. Chalkboard Resurfacer Coatings

Product Category Description:

Chalkboard resurfacer coatings, as defined in the U.S. EPA's architectural coatings regulation, are products formulated and recommended for application to chalkboards to restore a suitable surface for writing with chalk (U.S. EPA, 9/11/98). Chalkboard resurfacers represent very low sales in California according to our Architectural Coatings Survey. The products reported in the survey are waterborne, with a sales-weighted average VOC content of 220 g/l.

Table D-74
Chalkboard Refinisher Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast) (tons/day)
Solvent-Based	0	0	N/A	0
Water-Based	PD	PD	220	~0.00
Total	PD	PD	220	~0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

PD = Protected data.

Rationale for Not Including Product Category in the SCM:

Chalkboard resurfacers were provided with a separate category in the U.S. EPA's national architectural coatings regulation, with a 450 g/l VOC limit. However, in the ARB's SCM, we believe these coatings would generally be classified as industrial maintenance coatings with a 250 g/l VOC limit. This is because these products are generally for nonresidential use and are subjected to frequent heavy abrasion from writing with chalk and subsequent erasing. We believe the 250 g/l limit is appropriate because the sales-weighted average VOC content for these products as reported in the ARB's Architectural Coatings Survey is 220 g/l. There are no air pollution control agencies in California that provide a separate category with a higher VOC limit for these products in their rules.

REFERENCES

Air Resources Board. 1998 Architectural Coatings Survey Results. September, 1999. (ARB, 9/99)

United States Environmental Protection Agency. National Volatile Organic Compound Emission Standards for Architectural Coatings. 40 CFR Part 59, Subpart D, 63 FR 48848. September 11, 1998. (U.S. EPA, 9/11/98)

4. Concrete Curing and Sealing Compounds

Product Category Description:

Concrete curing and sealing compounds form a membrane, or a thin pliable layer of tissue, that covers the concrete surface to reduce the loss of water during the hardening process. They also seal old and new concrete to provide resistance against dirt, liquid, alkalis, acids, and ultraviolet light, while providing adhesion promotion qualities (U.S. SECG). This category includes three types of coatings: concrete curing, concrete sealing, and concrete curing and sealing compounds, which can provide both proper curing and long term protection.

Membrane curing compounds are the most common type of concrete curing compounds used for keeping moisture in the concrete to maintain satisfactory moisture content and temperature during curing, so that the concrete may develop the desired strength and hardness. These compounds are low in cost and can easily be brushed or sprayed on immediately after the concrete is laid without worrying about marring the surface (U.S. EPA BID).

Concrete sealing compounds provide a glossy film on concrete slabs to make them resistant to liquid and dirt impregnation. Sealing compounds are designed to keep moisture out of the concrete, especially in the first year when the concrete is curing and gaining strength. They also seal concrete against alkali, acid, ultraviolet light, and promote adhesion. Concrete curing and sealing compounds are used on buildings for long-term protection, aesthetics, and durability in addition to curing (U.S. EPA BID).

One coating company's product literature states that their acrylic copolymer emulsion blend cures concrete and provides a protective coating for interior and exterior concrete including terrazzo surfaces (marble or stone chips set in mortar), and has a VOC content of 325 g/l. The product also claims to provide a clear membrane for new or existing concrete, hardens new concrete by promoting a proper cure for increased abrasion resistance, and can be used on industrial floor slabs, parking garages, warehouses, walls and columns, interior and exterior concrete surfaces, passenger and freight terminals. The literature also states that the drying time of the product is less than one hour under laboratory conditions, 4-6 hours for foot traffic, and 6-10 hours for wheel traffic. (Euclid Chemical)

Rationale for Not Including Product Category in the SCM:

For almost 10 years, most of California's district rules have had a VOC limit of 350 g/l for the concrete curing compounds. Concrete curing and sealing compounds were included as a separate category in the U.S. EPA's national architectural coatings regulation, but it is not found in any state rules as a separate category. It was given a 700 g/l VOC limit in the national regulation. However, in the ARB's SCM, we believe these coatings are already covered under two architectural coating categories as: (1) concrete curing compounds with a 350 g/l VOC limit, or (2) waterproofing sealers with a 250 g/l VOC limit.

We believe these limits are appropriate as explained in the sections on concrete curing compounds (see section B, #2 Concrete Curing Compounds) and waterproofing sealers (see section A, #28 Waterproofing Sealers). For example, the ARB's 1998 Architectural and Industrial Maintenance Coatings Survey, shows that the concrete curing compound category has a 95 percent compliance at the proposed 350 g/l level, and that this category is heavily dominated by water-based formulations. We also note that there are a number of water-based products on the market that advertise optimum protection for the curing and sealing of concrete (SealTight). Additionally, the waterproofing sealer coatings category shows numerous complying products currently on the market at the proposed 250 g/l VOC limit.

Issues:

1. Issue: One company requested the National Rule limit of 700 g/l, because in warm, dry weather, compressive strength of concrete is considerably lower when a concrete curing compound (350 g/l VOC) is used, as compared to concrete prepared with a curing and sealing compounds (700 g/l VOC).

Response: Concrete curing compounds have had a VOC limit of 350 g/l in most district rules for almost 10 years. As explained in this section, there are a number of formulation technologies available that can meet the 350 g/l concrete curing compound limit while providing the needed curing and sealing of the concrete. Thus, staff does not think this category with a 700 g/l is warranted.

REFERENCES

Euclid Chemical Company. REZ-Seal VOX Product Literature from the Euclid Chemical Company's internet website. Http://www.euclidchemical.com. (Euclid Chemical)

United States Environmental Protection Agency. *Small Entity Compliance Guide*, National Volatile Organic Compound Emission Standards for Architectural Coatings. July 1999. (U.S. SECG)

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards," EPA-453/R-98-006b. August 1998. (U.S. EPA BID)

W. R. Meadows. SealTight Products Literature from W. R. Meadows' internet website. Http://www.wrmeadows.com. (SealTight)

5. Concrete Protective Coatings

Product Category Description:

Concrete protective coatings are products designed to protect concrete from spalling (fragment, flaking, or chipping) in freezing temperatures by protecting against water and chloride ion intrusion. Exposed concrete structures require protection from extreme weather conditions and salt spray that can break down concrete and deteriorate the structure. Water itself causes freeze/thaw damage and can be a dirt carrier, which can require expensive cleaning. In addition to water, substances dissolved in water, especially chloride compounds (from road salt) are more harmful than the freeze/thaw effects. Both chloride and sulfate ions carried by water chemically cause expansive forces that degrade rebar- and lime-containing construction materials. For example, the high alkalinity of new concrete protects steel rebars against corrosion, but as concrete ages, carbonation occurs, and the alkalinity of the concrete is lowered. Alkaline protection is lost and water-carrying chloride ions penetrate, causing steel to corrode. Coatings and sealers play an important role in extending the useful life of many structures by protection from these elements (PCI, 9/96).

These coatings are applied in a single coat, but produce a high-build layer over concrete, plaster, or other cement-like surfaces. They can be applied without a primer over form oils or uncured concrete. This category was included in the national survey under "high performance coatings." However, these coatings meet the definition of the waterproofing sealers category in the SCM, which states, "*a coating labeled as and formulated for application to a porous substrate for the primary purpose of preventing the penetration of water.*"

Rationale for Not Including Product Category in the SCM:

Concrete protective coatings were provided with a separate category in the U.S. EPA's national architectural coatings regulation, with an 350 g/l VOC limit. However, in the ARB's SCM, we believe these coatings are basically covered under the waterproofing sealer coating category with a 250 g/l proposed VOC limit. Under the waterproofing sealer category, our survey shows a 13 percent complying marketshare.

As a regulated category, only Oregon and Kentucky have this category with a VOC limit of 400 g/l in both states. Since this category was added to the final National Rule after the ARB 1998 Architectural and Industrial Maintenance Coatings Survey was completed, no data was collected on this specific category. However as discussed previously our survey did include the waterproofing sealers category, and based on this survey data, literature searches, and testing results, ARB does not believe it is necessary to have a separate category for the concrete protective coatings because the waterproofing sealers coatings' formulations can provide the protection needed.

Issues:

1. Issue: One company requested a category for concrete protective coatings at 400 g/l, because the lower VOC products cannot penetrate form oil and release agent materials, provide

the required adhesion, and provide long-term protection without requiring recoating.

Response: Staff is aware of numerous waterproofing sealer products that meet the proposed VOC limit of 250 g/l (see A, #28 Waterproofing Sealers). In addition, we believe the lower VOC products will adhere well with proper surface preparation. As with all coatings, the surface needs to be properly prepared prior to application of a coating for optimal performance. Thus, ARB does not believe it is necessary to have a separate category for these coatings.

REFERENCES

Paint & Coatings Industry, "*Silicone, Waterborne Penetrating Sealers Protect Mineral-Based Construction Materials*," September 1996, Volume XII, Number 8. (PCI, 9/96)

United States Environmental Protection Agency. *Small Entity Compliance Guide*, National Volatile Organic Compound Emission Standards for Architectural Coatings. July 1999. (U.S. EPA SECG)

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards," EPA-453/R-98-006b. August 1998. (U.S. EPA BID)

6. Concrete Surface Retarder Coatings

Product Category Description:

Concrete surface retarders are products designed to alter concrete hydration of freshly poured concrete. They are used to prolong the set time of the concrete, which allows for easy removal of the retarded mortar with a stiff brush and flushing with water to expose the aggregate. This produces an attractive exposed finish. At the job site, concrete surface retarders are used in the production of exposed aggregate finishes, to prevent hardening at a desired surface depth by altering the cement's hydration (U.S. EPA BID).

The liquid retarding ingredients include extender pigments, resin, and solvent that chemically interact with the concrete to prevent hardening where the retarder is applied on the surface (U.S. EPA SECG). Typically, concrete surface retarders are given 14-72 hours to affect the concrete system, after which time the non-hardened cement surface and the retarding liquid is either sacrificially brushed, blown, or washed away to give an architecturally pleasing surface of expose aggregate.

In addition to the liquid concrete surface retarders, some products consist of non-toxic, coated paper. The retarder paper produces the same altering affect for the concrete system as the liquid products. The paper requires no disposal problem or formwork clean-up, and is heat and abrasion resistant. Retarder paper can be used for patio slabs or architectural panels. The use of these paper products can be one-quarter of the cost of liquid retarders, and are available in varying strengths for a variety of aggregate sizes (Benton-Chemie).

Rationale for Not Including Product Category in the SCM:

This category is included in the U.S. EPA's architectural coatings national rule, with a VOC limit of 780 g/l. New Jersey and Texas do not regulate surface retarders because they do not believe they meet the definition of a coating. After investigating these products, ARB also concluded that they do not meet the definition of a coating. As noted above, these products are sacrificed by brushing or washing away, after they have affected the concrete system and do not create a hardened film. They are used only in the process of creating an exposed aggregate finish and are not part of the finished product.

Issues:

1. Issue: ARB received no comments on this category.

REFERENCES

Benton-Chemie, USA, Corporation. Retarder Paper Literature from Benton-Chemie's internet webiste. Http://www.betonchemieusa.com/RETARD.HTML. (Benton-Chemie)

United States Environmental Protection Agency. *Small Entity Compliance Guide*, National Volatile Organic Compound Emission Standards for Architectural Coatings. July 1999. (U.S. EPA SECG)

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards," EPA-453/R-98-006b. August 1998. (U. S. EPA BID)

7. Conversion Varnish Coatings

Product Category Description:

Conversion varnish, as defined in the U.S. EPA's architectural coatings regulation, is a clear, acid curing coating with an alkyd or other resin blended with amino resins and supplied as a single component or two-component product. The film formation is the result of an acid-catalyzed condensation reaction, affecting a transetherification at the reactive ethers of the amino resins (U.S. EPA, 9/11/98). These coatings are often referred to as "swedish finishes" and reportedly range in VOC content from 535 to 725 g/l (EPA, 8/98). These coatings are typically used for professional application to wood flooring.

Sales and emissions information for conversion varnishes is not available since the ARB's Architectural Coatings Survey did not include a separate category for these products.

Rationale for Not Including Product Category in the SCM:

Conversion varnishes were provided with a separate category in the U.S. EPA's national architectural coatings regulation, with a 725 g/l VOC limit. However, in the ARB's SCM, these coatings would be classified as varnishes with a 350 g/l VOC limit. We believe the 350 g/l VOC limit is appropriate because durable clear varnishes suitable for wood flooring are available at or below 350 grams VOC per liter. According to the ARB's Architectural Coatings Survey, nearly half of the clear varnish category is currently at or below the 350 g/l VOC level. Many of these products are suitable for wood flooring applications (Benjamin Moore, 1/6/00; Kelly-Moore, 12/97; Valspar, 1/6/00). There are no air pollution control agencies in California that provide a separate category with a higher VOC limit for conversion varnishes in their architectural coatings rules.

REFERENCES

Benjamin Moore & Company. Telephone conversation with ARB staff. January 6, 2000. (Benjamin Moore, 1/6/00).

Kelly-Moore Paint Company. Product Information Sheet for 2090 Series – Kel-Thane II. December, 1997. (Kelly-Moore, 12/97)

United States Environmental Protection Agency. "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards." EPA-453/R-98-006b. August 1998. (USEPA, 8/98)

United States Environmental Protection Agency. National Volatile Organic Compound Emission Standards for Architectural Coatings. 40 CFR Part 59, Subpart D, 63 FR 48848. September 11, 1998. (U.S. EPA, 9/11/98)

Valspar Corporation. Telephone Conversation with ARB staff. January 6, 2000. (Valspar, 1/6/00)

8. Extreme High Durability Coatings

Product Category Description:

Extreme high durability coatings, as defined in the U.S. EPA's national architectural coatings regulation, are air-dried coatings, including fluoropolymer-based coatings, that are formulated and recommended for touch-up of precoated architectural aluminum extrusions and panels (U.S. EPA, 9/11/98). These coatings must meet the weathering requirements of the American Architectural Manufacturer's Association (AAMA) specification 605-98, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels, Section 7.9. Section 7.9 establishes performance standards for color retention, chalk resistance, gloss retention, and resistance to erosion, for test panels subjected to Florida exposure for five years. Factory applied finishes to architectural aluminum extrusions and panels are often designed to meet all the performance standards of AAMA specification 605-98 (which has now been superceded by more stringent performance standards in AAMA 2605-98).

Follow up conversations with the manufacturers that reported extreme high durability coatings in the ARB's Architectural Coatings Survey revealed that all the products reported in the category were miscategorized (Spraylat, 12/9/99; Conco Paint, 12/9/99; Futura, 1/6/00), and would generally fall under the industrial maintenance category. In addition, the only known manufacturer of these products did not report any sales in California.

Rationale for Not Including Product Category in the SCM:

Extreme high durability coatings were provided with a separate category in the U.S. EPA's national architectural coatings regulation, with an 800 g/l VOC limit. Under the proposed SCM, these products would generally be classified as industrial maintenance coatings with a 250 gram/liter VOC limit. We believe this is appropriate because extreme high durability coatings are designed for "exterior exposure of metal structures and structural components," one of the criteria that qualify a coating as an industrial maintenance coating. We believe high performance industrial maintenance coatings meeting the proposed 250 g/l VOC limit can be used for architectural aluminum applications. If extreme high durability coatings were to be sold for residential uses, they would generally be subject to the nonflat coatings limit with a 150 gram/liter VOC limit. However, we believe the high cost of these products (approximately $280/gallon – K&L, 12/9/99) makes them unlikely for residential uses. As mentioned above, we do not believe these products are currently sold in California. We also note that since these products are designed for touch-up, the exempt one liter or smaller containers would probably be used. There are no air pollution control agencies in California that provide a separate category with a higher VOC limit for these products in their architectural coatings rules.

REFERENCES

Conco Paint. Telephone conversations with ARB staff. December 9, 1999 (Conco Paint, 12/9/99).

Futura Coatings. Telephone conversation with ARB staff. January 6, 2000. (Futura, 1/6/00)

Keeler and Long. Telephone conversation with ARB staff. December 9, 1999. (K&L, 12/9/99)

Spraylat Corporation. Telephone conversation with ARB staff. December 9, 1999. (Spraylat, 12/9/99).

United States Environmental Protection Agency. National Volatile Organic Compound Emission Standards for Architectural Coatings. 40 CFR Part 59, Subpart D, 63 FR 48848. September 11, 1998. (U.S. EPA, 9/11/98)

9. Heat Reactive Coatings

Product Category Description:

As defined in the U.S. EPA's architectural coatings regulation, heat reactive coatings are high performance phenolic-based coatings requiring a minimum temperature of 191°C (375°F) to 204°C (400°F) to obtain complete polymerization or cure (U.S. EPA, 9/11/98). These coatings are formulated and recommended for commercial and industrial use to protect substrates from degradation and maintain product purity in which one or more of the following extreme conditions exist:

1) continuous or repeated immersion exposure of 90 to 98 percent sulfuric acid, or oleum;
2) continuous or repeated immersion exposure to strong organic solvents;
3) continuous or repeated immersion exposure to petroleum processing at high temperatures and pressures; and
4) continuous or repeated immersion exposure to food or pharmaceutical products which may or may not require high temperature sterilization.

As shown in Table D-75, the heat reactive coatings reported in the ARB's Architectural Coatings Survey are solvent-based products with a sales weighted average VOC content of 378 grams VOC per liter of coating.

Table D-75
Heat Reactive Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast) (tons/day)
Solvent-Based	PD	PD	378	~0.00
Water-Based	0	0	N/A	N/A
Total	PD	PD	378	~0.00

***** Based on ARB's 1998 Architectural and Industrial Maintenance Coatings Survey (ARB, 9/99).
****** Grams VOC per liter of coating, less water and exempt compounds.
PD = Protected data.

Rationale for Not Including Product Category in the SCM:

In the U.S. Environmental Protection Agency's national Architectural and Industrial Maintenance Rule, heat reactive coatings are regulated as a separate category with a 420 g/l VOC limit. However, we do not believe it is necessary to include a separate category for these products in the ARB's SCM. These products are not generally applied in the field to stationary structures (Heresite). These products are designed to be cured at 375 to 400°F as stated in the definition. This generally means that metal products are coated and baked in an oven in original equipment manufacturing applications. As such, these coatings would generally be subject to district miscellaneous metal parts rules rather than architectural coatings rules. We also note that

industrial maintenance coatings meeting the 250 g/l VOC limit are available for chemical storage tanks and other applications where chemical resistance is needed. No district architectural coatings rules include a separate category with a higher limit for these coatings.

REFERENCES

Air Resources Board. 1998 Architectural Coatings Survey Results. September, 1999. (ARB, 9/99)

Heresite Protective Coatings, Incorporated. Telephone conversations with ARB staff. December 9, 1999. (Heresite)

United States Environmental Protection Agency. National Volatile Organic Compound Emission Standards for Architectural Coatings. 40 CFR Part 59, Subpart D, 63 FR 48848. September 11, 1998. (U.S. EPA, 9/11/98)

10. Impacted Immersion Coatings

Product Category Description:

Impacted immersion coatings are high-performance industrial maintenance products designed to be applied to steel structures subject to immersion in turbulent, debris-laden water. The impacted immersion coatings are specifically resistant to high-energy impact damage caused by floating ice or debris (U.S. EPA SECG). They are typically used in industrial, commercial, or institutional settings for use on immersed parts of bridges, dams, locks, oil rig stations, and power plants.

Rationale for Not Including Product Category in the SCM:

This category was included in the U. S. EPA's National Architectural and Industrial Maintenance Rule with a VOC limit of 450 g/l. Impacted immersion coatings are regulated under the ARB's SCM as industrial maintenance coatings because they are immersed in water, wastewater, or chemical solutions. Impacted immersion coatings were not included as a separate category in the ARB 1998 Architectural and Industrial Maintenance Coatings Survey; therefore, no data was collected on this category.

We do not believe a separate category is necessary because they can be reformulated to the 250 g/l limit using the technology for other industrial maintenance coatings. Our research has shown that some current solvent-free epoxies offer excellent surface wetting and penetration, characteristics that make them ideal for maintenance of pitted steel and eroded concrete (JPLC, 11/99).

Issues:

1. Issue: ARB did not receive any comments on the impacted immersion coatings. There are no known unresolved issues with this category

REFERENCES

Journal of Protective Coatings & Linings, "*Epoxy Systems for Power Station Conduits, Penstocks, and Cooling Water Intakes,*" November 1999, Volume 16, Number 11. (JPLC, 11/99)

United States Environmental Protection Agency. *Small Entity Compliance Guide,* National Volatile Organic Compound Emission Standards for Architectural Coatings. July 1999. (U.S. EPA SECG)

United States Environmental Protection Agency (U.S. EPA), "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards," EPA-453/R-98-006b, August 1998. (U.S. EPA BID)

11. Nonferrous Ornamental Lacquer Coatings

Product Category Description:

Nonferrous ornamental metal lacquers and surface protectant (or "nonferrous ornamental lacquers"), as defined in the U.S. EPA's architectural coatings regulation, are clear coatings formulated and recommended for application to ornamental architectural metal substrates (bronze, stainless steel, copper, brass, and anodized aluminum) to prevent oxidation, corrosion, and surface degradation. (U.S. EPA, 9/11/98)

Sales and emissions information for nonferrous ornamental lacquers is not available since the ARB's Architectural Coatings Survey did not include a separate category for these products.

Rationale for Not Including Product Category in the SCM:

Nonferrous ornamental lacquers were provided with a separate category in the U.S. EPA's national architectural coatings regulation, with an 870 g/l VOC limit. However, in the ARB's SCM, we believe these coatings would be classified as either: (1) rust preventive coatings with a 400 g/l VOC limit, if they are for residential use; or (2) industrial maintenance coatings with a 250 g/l VOC limit, if they are for nonresidential use. Due to the extremely high VOC limit established for these products, it is unlikely that they are used in areas of California subject to architectural coatings rules (except under the small size container exemption). There are no air pollution control agencies in California that provide a separate category with a higher VOC limit for these products in their architectural coatings rules.

REFERENCES

United States Environmental Protection Agency. National Volatile Organic Compound Emission Standards for Architectural Coatings. 40 CFR Part 59, Subpart D, 63 FR 48848. September 11, 1998. (U.S. EPA, 9/11/98)

12. Nuclear Coatings

Product Category Description:

Nuclear coatings, as defined in the U.S. EPA's architectural coatings regulation, are protective coatings formulated and recommended to seal porous surfaces such as steel (or concrete) that otherwise would be subject to intrusion by radioactive materials (U.S. EPA, 9/11/98). These coatings must be resistant to long-term (service life) cumulative radiation (per ASTM Method D 4082-89), relatively easy to decontaminate, and resistant to various chemicals to which the coatings are likely to be exposed (per ASTM Method D 3912-80). Nuclear coatings as defined can be used in both Level I (containment) and Level II (noncontainment) areas.

ASTM Method D 4082-89, Standard Test Method for Effects of Gamma Radiation on Coatings for Use in Light-Water Nuclear Power Plants, is designed to provide a uniform test to assess the suitability of coatings, used in nuclear power facilities, under continuous readiation exposure for the projected 40-year lifetime of the facilities, including radiation during a DBA (design basis accident). The test method specifies procedures for exposing sample coatings applied to steel panels and concrete blocks to gamma radiation under specified conditions, and then checking for various coating defects.

ASTM Method D 3912-80 (Reapproved 1989), Standard Test Method for Chemical Resistance of Coatings Used in Light-Water Nuclear Power Plants, is designed to measure the chemical resistance of coatings used in light-water nuclear power plants. The test method specifies procedures for immersing sample coatings applied to steel panels and concrete blocks in various test solutions commonly used in nuclear power facilities.

There are two nuclear power facilities operating in California that utilize nuclear coatings in maintenance and repair operations: (1) the Diablo Canyon site near Avila Beach (San Luis Obispo County), and (2) the San Onofre site near San Clemente (San Diego County). The Diablo Canyon site is operated by the Pacific Gas and Electric Company, and the San Onofre site is operated by the Southern California Edison Company and San Diego Gas and Electric Company.

As shown in the table below, the nuclear coatings that reported in the ARB's Architectural Coatings Survey include both solvent-borne and water-borne coatings. According to the ARB's Architectural Coatings Survey, about 700 gallons of nuclear coatings were sold in 1996, resulting in VOC emissions of less than one ton per year.

Table D-76
Nuclear Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast) (tons/day)
Solvent-Based	PD	PD	248	~0.00
Water-Based	PD	PD	46	~0.00
Total	4	697	50	~0.00

* Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

PD = Protected data.

Rationale for Not Including Product Category in the SCM:

In the U.S. Environmental Protection Agency's national Architectural and Industrial Maintenance Rule, nuclear coatings are regulated as a separate category with a 450 g/l VOC limit. U.S. EPA based this limit on the 400 g/l limit for nuclear coatings in the shipbuilding and ship repair national emission standards for hazardous air pollutants (which includes a thinning exemption for coatings applied in cold weather). However, in the ARB's SCM, nuclear coatings would generally be classified as industrial maintenance coatings with a 250 g/l VOC limit.

We do not believe it is necessary to create a separate category with a higher VOC limit for nuclear coatings because there are currently products available that comply with the proposed 250 g/l limit in the SCM. The complying products include primers and surfacers (Carboline 893; K&L Nos. 6129 and 6548-S) and topcoats (Carboline 890; K&L Nos. 4500, 5000, and 9600 N). The complying products include products for both concrete (Carboline 890 and 893; K&L 6548-S, 4500, 5000 – floors only, and 6129 – floors only) and steel (Carboline 890 and 893; and K&L 4500, 9600 N, and 5000 – floors only). Discussions with personnel at California's nuclear power facilities indicate that the nuclear coatings they use are below 250 g/l (Southern California Edison, 1/6/00), or that they primarily use low VOC products and can use exempt quart for the occasions when a product above 250 g/l may be needed (Pacific Gas and Electricity, 1/13/00). We also note that the sales-weighted average VOC content of these coatings, as reported in the ARB's Architectural Coatings Survey is 50 g/l. No districts currently include a separate category with a higher VOC limit for nuclear coatings in their architectural coatings rules.

Issues:

1. Issue: We believe there is a need for nuclear coatings as defined in the National Rule. Our research shows that an average nuclear power plant will use up to 500 gallons per year on maintenance of Level 1 and Level 2 areas. The worst case would be if a plant completely repainted all these areas, which would require approximately 4,000 gallons per unit. This is an unusual occurrence and not normally expected through the life of the plant.

Response: Although the nuclear coatings category is not large, we do not believe a

separate category with a higher VOC limit is necessary. As discussed above, we have identified several complying products that meet the 250 g/l VOC limit for industrial maintenance coatings.

2. Issue: Although the survey reveals that there are low VOC nuclear coatings, you can't assume that they can be used in all areas. Nuclear coatings for steel are not low VOC. The cost for getting a coating certified is enormous, and at those small volumes, there is no point in reformulating.

Response: As discussed above, nuclear coatings that are below the 250 gram/liter level are available for both concrete and steel, and California's nuclear power facilities are primarily purchasing these low VOC products. We realize that the volumes of nuclear coatings sold are not large and that some manufacturers will need to evaluate whether it is cost-effective to reformulate their products that are currently above 250 g/l. However, at least one manufacturer reported developing a low VOC nuclear coating in 1983 specifically for California due to VOC regulations (K&L, 12/7/99), indicating that it is not necessarily economically infeasible to invest in lower VOC nuclear formulations. We also note that if a manufacturer chooses not to reformulate certain higher VOC products, it is expected that customers will purchase more of the manufacturer's existing complying products, or more of a competitor's complying products, resulting in economic benefits to manufacturers offering these lower VOC products. Manufacturers may also choose to offer the product in the exempt smaller containers, for the few occasions where a California customer specifies a product above 250 g/l VOC.

REFERENCES

Air Resources Board. 1998 Architectural Coatings Survey Results. September, 1999. (ARB, 9/99)

Carboline Company. Product Data Sheets for Carboline 890 dated 1/29/99, and 893 dated 8/20/98. (Carboline 890 and 893)

Keeler and Long, Incorporated. Website http:// www.ppgaf.com/k&l/ssu/ssu1.htm. Printed 11/23/99. (K&L Nos. 4500, 5000, 9600 N, 6129 and 6548-S)

Keeler & Long, Incorporated. Telephone conversation with ARB staff. December 7, 1999. (K&L, 12/7/99)

Pacific Gas and Electricity. Telephone conversation with ARB staff. January 13, 2000. (Pacific Gas and Electricity, 1/13/00)

Southern California Edison. Electronic mail to ARB staff. January 6, 2000. (Southern California Edison, 1/6/00)

United States Environmental Protection Agency. National Volatile Organic Compound Emission Standards for Architectural Coatings. 40 CFR Part 59, Subpart D, 63 FR 48848. September 11, 1998. (U.S. EPA, 9/11/98)

13. Repair and Maintenance Thermoplastic Coatings

Product Category Description:

Repair and maintenance thermoplastic coatings, as defined in the U.S. EPA's architectural coatings regulation, are industrial maintenance coatings that have vinyl or chlorinated rubber as the primary resin and are recommended solely for the repair of existing vinyl or chlorinated rubber coatings without the full removal of the existing coating system (U.S. EPA, 9/11/98).

As shown in the table below, the repair and maintenance thermoplastic coatings reported in the ARB's Architectural Coatings Survey have a sales-weighted average VOC content of less than 1 gram VOC per liter. To protect the confidentiality of proprietary data, sales or other information cannot be provided for this category.

Table D-77
Repair and Maintenance Thermoplastic Coatings*

	Number of Products	Category Sales (gallons/year)	Sales Weighted Average VOC (grams/liter)**	VOC Emissions (excluding South Coast) (tons/day)
Solvent-Based	PD	PD	<1	~0.00
Water-Based	PD	PD	159	~0.00
Total	PD	PD	<1	~0.00

***** Based on ARB's 1998 Architectural Coatings Survey Results Final Report (ARB, 1999).

****** Grams VOC per liter of coating, less water and exempt compounds.

PD = Protected data.

Rationale for Not Including Product Category in the SCM:

In the U.S. Environmental Protection Agency's national Architectural and Industrial Maintenance Rule, repair and maintenance thermoplastic coatings are regulated as a separate category with a 650 g/l VOC limit. However, in the ARB's SCM, these coatings would generally be classified as industrial maintenance coatings with a 250 gram/liter VOC limit. We do not believe it is necessary to create a separate category with a higher VOC limit for repair and maintenance thermoplastic coatings because the sales weighted average VOC content of the products reported in the ARB's survey indicate that current products are well below this VOC level. Only two manufacturers reported products in this category in the ARB's Architectural Coatings Survey. One manufacturer said that their products were actually for original equipment manufacturer (OEM) applications, not architectural coatings (Simpsons Coating Group). We also note that no district rules currently contain a separate category with a higher VOC limit for these products.

REFERENCES

Air Resources Board. 1998 Architectural Coatings Survey Results. September, 1999. (ARB, 9/99)

Simpsons Coating Group. Telephone conversation with ARB staff. December 15, 1999. (Simpsons Coating Group)

United States Environmental Protection Agency. National Volatile Organic Compound Emission Standards for Architectural Coatings. 40 CFR Part 59, Subpart D, 63 FR 48848. September 11, 1998. (U.S. EPA, 9/11/98)

14. Stain Controller Coatings

Product Category Description:

Stain controller coatings, as defined in the U.S. EPA's architectural coatings regulation, are conditioners or pretreament coatings formulated and recommended for application to wood prior to the application of a stain in order to prevent uneven penetration of the stain (U.S. EPA, 9/11/98). These products may be called wood conditioners, prestains, or washcoats. They are often recommended for soft woods such as pine, which are more likely to absorb stains unevenly.

Sales and emissions information for stain controllers is not available since the ARB's Architectural Coatings Survey did not include a separate category for these products. According to the one manufacturer, over 97 percent of the total sales for these coatings are exempt under the small container exemption (USEPA, 8/98).

Rationale for Not Including Product Category in the SCM:

Stain controllers were provided with a separate category in the U.S. EPA's national architectural coatings regulation, with an 720 g/l VOC limit. However, in the ARB's SCM, these coatings would generally be classified as low solids coatings with a VOC content limit of 120 g/l, *including water and exempt compounds.* We believe that this is appropriate because lower VOC water-based technology is available for these products. Several district architectural coatings and wood products coating rules in California specify a 120 g/l VOC limit for these products or related low-solids coatings. In addition, as mentioned above, these products are primarily sold in smaller, exempt containers. Finally, no district architectural coatings rule in California contains a separate category with a higher VOC limit for these products.

Issues:

1. Issue: This category was included in an early draft rule submitted by NPCA for Reg-Neg. It is a low-volume, specialty niche coating that it is not cost-effective to reformulate. These coatings would have to be very low solids to accept stain, but the use of water as a solvent would raise the grain of wood. It was added to the final version of the National Rule. The National Rule limit is 720 g/l.

Response: We do not believe it is necessary to provide a separate category with a 720 g/l VOC limit for these products. These products are currently complying with the 120 g/l VOC limit for low solids coatings in many areas of California, or they are only sold in small containers. Water-based formulations may require some sanding after application in cases were grain raising occurs, or a solvent-based product sold in one liter or smaller container sizes may be used. However, we note that some solvent-based products also recommend sanding after application (Benjamin Moore).

REFERENCES

Benjamin Moore and Company. Product Information Sheet for Benwood Wood Conditioner 236. September, 1999.

United States Environmental Protection Agency (U.S. EPA), "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards," EPA-453/R-98-006b, August 1998.

United States Environmental Protection Agency. National Volatile Organic Compound Emission Standards for Architectural Coatings. 40 CFR Part 59, Subpart D, 63 FR 48848. September 11, 1998. (U.S. EPA, 9/11/98)

15. Thermoplastic Rubber Coatings and Mastics

Product Category Description:

Thermoplastic rubber coatings and mastics ("thermoplastic rubber coatings"), as defined in the U.S. EPA's architectural coatings regulation, are products formulated and recommended for application to roofing or other structural surfaces and that incorporate no less than 40 percent by weight of thermoplastic rubbers in the total resin solids, and may also contain other ingredients including, but not limited to, fillers, pigments, and modifying resins (U.S. EPA, 9/11/98).

Follow up conversations with the manufacturers that reported thermoplastic rubber coatings in the ARB's Architectural Coatings Survey revealed that all the products reported in the category were miscategorized (Fine Line Paint, 1/12/00). The only known manufacturers of these products do not currently sell them in California.

Rationale for Not Including Product Category in the SCM:

Thermoplastic rubber coatings were provided with a separate category in the U.S. EPA's national architectural coatings regulation, with a 550 g/l VOC limit. However, in the ARB's SCM, these coatings would generally be classified as roof coatings with 250 g/l VOC limit. We believe that this is appropriate because lower VOC elastomeric latex or bituminous roof coatings, described elsewhere in this Chapter, are available that provide the same basic function. We also note that these products are not currently being sold in California. Finally, no district architectural coatings rule in California contains a separate category with a higher VOC limit for these products.

Issues:

1. **Issue:** A category with a 550 g/l VOC content limit should be provided for thermoplastic rubber and mastic coatings, as recognized in the national AIM rule. Alternatively, we suggest the expansion of the metallic pigmented coating category to also include highly reflective coating.

Response: We do not believe it is necessary to create a separate category with a higher VOC limit for these products because currently used bituminous and latex roofing products are available at less than half the VOC content of a 550 g/l thermoplastic rubber material. We also do not believe it is appropriate to modify the metallic pigmented coating category to include products that contain no metal.

2. **Issue:** Our thermoplastic rubber products are more durable, and result in less emissions over time than comparable bituminous roof products.

Response: We have no data to substantiate that thermoplastic rubber roofing products outlast their bituminous counterparts. We also note that latex roofing products are available.

3. **Issue:** Our thermoplastic rubber products work in situations where water-based or

bituminous products fail. For example, they adhere well to single-ply membranes and adhere well when exposed to ponding water.

Response: We have no data to substantiate these performance claims. Also, since thermoplastic rubber products are not used in California, we assume that other roofing products can be used to address these situations.

REFERENCES

Fine Line Paint. Telephone conversation with ARB staff. January 12, 2000. (Fine Line Paint, 1/12/00)

United States Environmental Protection Agency. National Volatile Organic Compound Emission Standards for Architectural Coatings. 40 CFR Part 59, Subpart D, 63 FR 48848. September 11, 1998. (U.S. EPA, 9/11/98)

16. Zone Marking Coatings

Product Category Description:

Zone marking coatings are products designed for use for marking and stripping driveways, parking lots, sidewalks, curbs, airport runways, or other traffic surfaces. The U. S. EPA established the zone marking coatings as a separate category from the traffic marking coatings. Under the U.S. EPA definition, the zone marking products have a size restriction requiring the product category to be sold or distributed in five gallon containers or smaller. Since the zone marking coatings have a higher VOC limit that traffic marking coatings, the restriction in size was established to discourage the use of these coatings in large-scale applications, such as those for general traffic markings intended for public roads and highways. (U.S. EPA SECG)

Rationale for Not Including Product Category in the SCM:

Zone marking coatings are included in U.S. EPA's architectural coatings national rule, with a 450 g/l VOC limit. However, this category does not appear in any state rules. Zone marking coatings are regulated under the ARB's SCM as traffic marking coatings, which the SCM defines as, "*a coating formulated and recommended for marking and striping street, highways, or other traffic surfaces including, but not limited to, curbs, berms, driveways, parking lots, sidewalks, and airport runways.*" We do not believe a separate category is necessary because these coatings can be reformulated to the 150 g/l limit using the technology for traffic marking coatings. Zone marking coatings were not included in the ARB 1998 Architectural and Industrial Maintenance Coatings Survey; therefore, no data was collected on this category. However, ARB did request data on the traffic marking coating category, which includes the zone marking coatings by definition.

The ARB 1998 survey data for traffic coatings was based on information submitted by 30 manufacturers covering 189 different products. These products included water-based, solventborne, and 100 percent solid formulations. The survey indicated that the 1990 sales for water-based formulations (for traffic coating products) to be over a million gallons, with an average VOC content of 121 g/l, well below the proposed limit. This indicates a 53 percent complying marketshare for traffic marking coatings at the proposed 150 g/l VOC level.

Although no single traffic marking material is the most desirable in all applications, a combination of low- and zero-VOC-emitting marking materials can provide the performance necessary for highway safety. Water-based zone marking paints are available and the durability is comparable with that of other solventborne marking paints. One traffic line and marking product's literature states that it has a 45 g/l VOC content (Kelly-Moore). It also describes the product as durable, abrasion resistant flat acrylic finish for marking lanes, parking lots, industrial road traffic lanes, curbs, or areas on concrete or asphalt surfaces. Other typical low-VOC traffic marking coatings that meet the 150 g/l limit include coatings formulated as acetone-based solventborne coatings, epoxies, thermoplastics, permanent markers, and polyester tapes (U. S. EPA BID). In addition, the overall annualized costs of using water-based and zero-VOC coatings are lower than their solventborne counterparts. Compliant traffic coatings are commercially available and are being used by local governments, and Cal Trans, as well as

professional contractors at all levels (U. S. EPA BID). In addition, various tests by national government agencies have concluded that once dry, water-based coatings are at least equally durable as solventborne coatings (MPC, 1995).

Issues:

1. Issue: ARB did not receive any comments on this category. There are no known unresolved issues with this category.

REFERENCES

Goff, Alex. Modern Paint and Coatings. "Traffic Coatings Anticipate EPA Regulations." July 1995. (MPC, 1995)

Kelly-Moore Paint Company. Product Literature for 1450-Latex Traffic Line and Marking Paint.

United States Environmental Protection Agency. *Small Entity Compliance Guide*, National Volatile Organic Compound Emission Standards for Architectural Coatings. July 1999. (U.S. EPA SECG)

United States Environmental Protection Agency (U.S. EPA). "National Volatile Organic Compound Emission Standards for Architectural Coatings – Background for Promulgated Standards," EPA-453/R-98-006b. August 1998. (U.S. EPA BID)